Draft Technical Report
Biology

Volume 3

WyCoalGas Coal Gasification Project

Prepared for

U.S. Bureau of Land Management

August 1981

Woodward-Clyde Consultants
Three Embarcadero Center, Suite 700, San Francisco, CA 94111

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CONTENTS

Chapter	Page
1: INTRODUCTION	1-1
1.A VEGETATION	1-1
1.B TERRESTRIAL WILDLIFE	1-3
1.C AQUATIC BIOLOGY	1-5
1.D THREATENED AND ENDANGERED SPECIES	1-8
2: AFFECTED ENVIRONMENT	2-1
2.A COAL GASIFICATION PLANT	2-1
2.A.1 Coal Gasification Plant	2-1
Vegetation	2-1
Terrestrial Wildlife	2-8
Aquatic Biology	2-13
Threatened and Endangered Species	2-13
2.A.2 Water Supply System	2-17
North Well Field	2-17
Vegetation	2-17
Terrestrial Wildlife	2-18
Aquatic Biology	2-21
Threatened and Endangered Species	2-25
South Well Field	2-25
Vegetation	2-25
Terrestrial Wildlife	2-27
Aquatic Biology	2-28
Threatened and Endangered Species	2-30
LaPrele Reservoir	2-31
Aquatic Biology	2-31
Threatened and Endangered Species	2-31
Combs Reservoir	2-32
Vegetation	2-32
Terrestrial Wildlife	2-33
Aquatic Biology	2-36
Threatened and Endangered Species	2-36

Chapter		Page
	North Platte Intake	2-39
	Vegetation	2-39
	Terrestrial Wildlife	2-40
	Aquatic Biology	2-40
	Threatened and Endangered Species	2-44
	Water Pipelines	2-45
	Vegetation	2-46
	Terrestrial Wildlife	2-46
	Aquatic Biology	2-48
	Threatened and Endangered Species	2-48
2.A.3	Railroad	2-48
	Vegetation	2-48
	Terrestrial Wildlife	2-53
	Aquatic Biology	2-55
	Threatened and Endangered Species	2-58
2.A.4	Transmission Lines	2-63
	Vegetation	2-63
	Terrestrial Wildlife	2-63
	Aquatic Biology	2-63
	Threatened and Endangered Species	2-63
2.A.5	Roads	2-65
	Vegetation	2-65
	Terrestrial Wildlife	2-65
	Aquatic Biology	2-65
	Threatened and Endangered Species	2-65
2.B	MINE AND ASSOCIATED FACILITIES	2-68
2.B.1	Mine	2-68
	Vegetation	2-68
	Terrestrial Wildlife	2-74
	Aquatic Biology	2-80
	Threatened and Endangered Species	2-92
2.B.2	Transmission Lines (Awaiting Proj. Descrip.Inform.)	2-96
	Vegetation	
	Terrestrial Wildlife	
	Aquatic Biology	
	Threatened and Endangered Species	
2.B.3	Access Road	2-96
	Vegetation	2-96
	Terrestrial Wildlife	2-96
	Aquatic Biology	2-96
	Threatened and Endangered Species	2-96

Chapter		Page
2.C	PRODUCT PIPELINE	2-97
	Vegetation	2-97
	Terrestrial Wildlife	2-104
	Aquatic Biology	2-106
	Threatened and Endangered Species	2-116
3:	ENVIRONMENTAL CONSEQUENCES	3-1
3.A	GENERIC IMPACT DISCUSSION	
	3.A.1 Vegetation	3-1
	3.A.2 Terrestrial Wildlife	3-6
	3.A.3 Aquatic Biology	3-10
3.B	COAL GASIFICATION PLANT AND ASSOCIATED FACILITIES	3-25
	3.B.1 Vegetation	3-25
	3.B.2 Terrestrial Wildlife	3-26
	3.B.3 Aquatic Biology	3-29
	3.B.4 Threatened and Endangered Species	3-30
3.C	WATER SUPPLY SYSTEM	3-30
	3.C.1 Vegetation	3-30
	3.C.2 Terrestrial Wildlife	3-32
	3.C.3 Aquatic Biology	3-37
	3.C.4 Threatened and Endangered Species	3-43
3.D	RAILROAD	3-45
	3.D.1 Vegetation	3-45
	3.D.2 Terrestrial Wildlife	3-46
	3.D.3 Aquatic Biology	3-50
	3.D.4 Threatened and Endangered Species	3-50
3.E	MINE AND ASSOCIATED FACILITIES	3-52
	3.E.1 Vegetation	3-52
	3.E.2 Terrestrial Wildlife	3-56
	3.E.3 Aquatic Biology	3-64
3.F	PRODUCT PIPELINE	3-65
	3.F.1 Vegetation	3-65
	3.F.2 Terrestrial Wildlife	3-67
	3.F.3 Aquatic Biology	3-70
	3.F.4 Threatened and Endangered Species	3-71

Chapter			Page
3.G	NONROUTINE OPERATIONS		3-73
	3.G.1	Vegetation	3-73
	3.G.2	Terrestrial Wildlife	3-75
	3.G.3	Aquatic Biology	3-77
4:	PROJECT ALTERNATIVES		4-1
4.A	BURLINGTON NORTHERN AND ANTELOPE SPUR RAILROAD		4-1
	4.A.1	Vegetation	4-1
	4.A.2	Terrestrial Wildlife	4-2
	4.A.3	Aquatic Biology	4-3
	4.A.4	Threatened and Endangered Species	4-3
4.B	ACQUISITION OF PROCESS WATER ENTIRELY FROM LAPRELE RESERVOIR AND THE MADISON FORMATION		4-4
	4.B.1	Construction	4-4
	4.B.2	Operation, Maintenance, and Abandonment	4-4
4.C	ACQUISITION OF PROCESS WATER ENTIRELY FROM THE LANCE, FOX, AND MADISON FORMATIONS		4-5
	4.C.1	Construction	4-5
	4.C.2	Operation, Maintenance, and Abandonment	4-5
4.D	USE OF COAL FINES PRODUCED AT THE MINE FOR PRODUCTION OF ELECTRICITY AT THE PLANT SITE		4-5
	4.D.1	Construction	4-5
	4.D.2	Operation, Maintenance, and Abandonment	4-5
5:	CUMULATIVE IMPACT ANALYSIS		5-1
5.A	REGIONAL AFFECTED ENVIRONMENT		5-1
	5.A.1	Vegetation	5-2
	5.A.2	Terrestrial Wildlife	5-6
	5.A.3	Aquatic Biology	5-10
5.B	ENVIRONMENTAL CONSEQUENCES		5-12
	5.B.1	Vegetation	5-12
	5.B.2	Terrestrial Wildlife	5-14
	5.B.3	Aquatic Biology	5-20

6: GLOSSARY 6-1

7: LITERATURE CITED 7-1

Appendix A: TERRESTRIAL WILDLIFE A-1

Appendix B: THREATENED AND ENDANGERED SPECIES B-1

Appendix C: VEGETATION C-1

FIGURES

Figure		Page
1	Natural Vegetation Types	1-4
2	Animal Habitats	1-6

TABLES

Table		Page
2-1	Major Plant Species and Percentage of the Total Plant Community on Shallow Clayey (SwCy) Range Sites in the 10-14 inch Northern Plains Precipitation Zone, Wyoming	2-3
2-2	Major Plant Species and Percentage of the Total Plant Community on Shallow Sandy (SwSy) Range Sites in the 10-14 inch Northern Plains Precipitation Zone, Wyoming	2-4
2-3	Major Plant Species and Percentage of the Total Plant Community on Shallow Loamy (SwLy) Range Sites in the 10-14 inch Northern Plains Precipitation Zone, Wyoming	2-5
2-4	Initial Stocking Rates in the 10-14 inch Northern Plains Precipitation Zone	2-7
2-5	Animal Unit Month Estimates for Selected Plots Within or Adjacent to the Proposed North Well Field, Converse County, Wyoming	2-19
2-6	Vegetation Habitat Types Removed from Production by Construction of Gathering Lines and Associated Facilities in the North Well Field	2-21
2-7	Stream Evaluation Definitions Used by U.S. Fish and Wildlife Service and Wyoming Game and Fish Commission (1978) and Wyoming Game and Fish Department (1977a)	2-22
2-8	Fishes of the Cheyenne River Basin, Wyoming	2-23
2-9	Vegetation Habitat Types That Would Be Traversed by Water Supply Gathering Lines in the South Well Field, Converse County, Wyoming	2-26
2-10	Fishes Collected from LaPrele and Little Box Elder Creeks	2-29
2-11	Acreages of Vegetation Types That Would Be Affected by Construction of Components of Combs Reservoir on Soldier Creek	2-34
2-12	Fishes Collected in the North Platte River near Soldier Creek Confluence During April and May 1975	2-37

Table		Page
2-28	Approximate Acres of Each Vegetation Habitat Type within the Rochelle Mine Site	2-69
2-29	Plant Taxa from Campbell County, Wyoming	2-70
2-30	Range Condition and Carrying Capacity by Range Site for Vegetation Types on the Rochelle Mine Site	2-73
2-31	Ranges of the Chemical and Physical Characteristics of Standing Surface Waters on the Mine Area in the Summer of 1973	2-81
2-32	Trace Elements in Water Samples Collected in the Mine Area in the Summer of 1973	2-83
2-33	Zooplankton Taxa Identified from the Playas and Gully-Plug Reservoirs on the Mine Area in the Summer of 1973	2-84
2-34	Benthic Taxa Identified from the Stock Ponds and Gully-Plug Reservoirs on the Mine in the Summer of 1973	2-85
2-35	Fishes Collected from School and Little Thunder Creeks	2-88
2-36	Taxonomic Classification of the Benthic Fauna of School and Little Thunder Creeks	2-90
2-37	Fishes Collected from Antelope Creek	2-93
2-38	Taxonomic Classification of Benthic Fauna from Antelope Creek	2-94
2-39	Initial Stocking Rate in the 12-14 inch Northern Plains Precipitation Zone	2-99
2-40	County Summary of Vegetation Types Affected by the Proposed Product Pipeline Corridor	2-102
2-41	Animal Unit Months Temporarily Lost During Construction of the Proposed Pipeline Product Corridor	2-105
2-42	Locations and Flow Characteristics of the Streams and Rivers That Would Be Crossed by the Proposed Product Pipeline	2-107
2-43	Locations of Known Golden Eagle Nests and Roosts within 5 Miles of the Proposed Product Pipeline	2-110
2-44	Fishes Known to Occur in the Drainages That Would Be Crossed by the Proposed Product Pipeline	2-112

Table		Page
2-45	Endangered, Threatened, Rare, and Status Review Species That Could Occur in the Vicinity of the Proposed Product Pipeline	2-117
2-46	Black-Footed Ferret Sightings Reported in Converse, Platte, and Laramie Counties, Wyoming, Between 1851 and 1973	2-119
3-1	Summary of Acres Temporarily and Permanently Disturbed for All Project Components by Natural Vegetation Type	3-4
3-2	Estimates of Macroinvertebrate and Equivalent Fish Flesh Biomass Which May Be Lost as a Result of River Crossing Construction	3-19
3-3	Raptor Nests in the Vicinity of Proposed Water Supply System Components	3-35
3-4	Reported Spawning Periods, Substate Preferences, Egg Types, Number of Eggs Produced and Incubation Periods of Fishes Reported in the Area of North Platte River	3-42
3-5	Estimates of Acreages of Each Vegetation Type in the Eastern Powder River Basin	3-53
3-6	Percent Un-Ionized Ammonia in Aqueous Ammonia Solutions	3-81
5-1	Acreages of Vegetation Types Delineated in the Eastern Powder River Basin by the U.S. Bureau of Land Management	5-3
5-2	Average Number of Deer and Antelope per Square Mile in Herd Units in the Eastern Power River Basin	5-8
5-3	Density Estimates of Mammals, Birds, Amphibians, and Reptiles, by Vegetation Type, for the Eastern Powder River Basin	5-9
5-4	Checklist of the Fishes of the Eastern Powder River Region	5-11
5-5	Cumulative Losses of Vegetation, Under the Probable Level of Development, by All Activities in the Eastern Powder River Basin	5-13
5-6	Estimated Direct Population Losses of Mammals and Birds Due to Regional Development in the Eastern Power River Basin	5-15
5-7	Estimated Loss of Mammal and Bird Progeny Due to Development in the Eastern Powder River Basin	5-16

Table		Page
5-8	Projected Losses of Big Game Species in the Eastern Powder River Basin Due to Poaching and Vehicle Kills	5-17
5-9	Maximum Estimates of Macroinvertebrate and Equivalent Fish Flesh Biomass Which May Be Lost as a Result of Cumulative Regional Developments	5-22
5-10	Comparison of Maximum Heavy Metal Concentrations in the Little Powder, Cheyenne, and Belle Fourche Rivers; Black Thunder Mine Leachates; Soils and Sagebrush Samples Throughout the Region; and REcommended Maximum Concentrations for Various Water Uses	5-24
A-1	Vegetative Habitat Types Which Would Be Traversed by the Proposed WyCoalGas Product Pipeline through Converse, Platte, and Laramie Counties, Wyoming and Weld County, Colorado	
B-1	Amphibians and Reptiles That Could Occur in the Vicinity of the Coal Gasification Plant and Associated Facilities	
B-2	Birds That Could Occur in the Vicinity of the Coal Gasification Plant and Associated Facilities	
B-3	Mammals That Could Occur in the Vicinity of the Coal Gasification Plant and Associated Facilities	
B-4	Amphibians and Reptiles That Could Occur in the Vicinity of the Rochelle Mine and Associated Facilities	
B-5	Birds That Could Occur in the Vicinity of the Rochelle Mine and Associated Facilities	
B-6	Mammals That Could Occur in the Vicinity of the Rochelle Mine and Associated Facilities	
B-7	Amphibians and Reptiles That Could Occur in the Vicinity of the Proposed ~~Product~~ Product Pipeline Corridor	
B-8	Birds That Could Occur in the Vicinity of the Proposed Product Pipeline Corridor	
B-9	Mammals That Could Occur in the Vicinity of the Proposed Product Pipeline Corridor	
C-1	Wildlife Considered Rare in Wyoming	
C-2	Threatened and Endangered Species Protected by Colorado Under Chapter 10 of the Wildlife Commission Regulations	

Table

C-3 Plant Taxa Native to Wyoming Being Considered for Listing as Endangered or Threatened under the Endangered Species Act of 1973

C-4 Plant Taxa Currently Proposed for Listing as Endangered or Threatened under the Endangered Species Act of 1973

C-5 Plant Taxa Currently Listed as Endangered or Threatened in Colorado

C-6 Plant Taxa Native to Colorado Being Considered for Listing as Endangered or Threatened under the Endangered Species Act of 1973

Chapter 1
INTRODUCTION

This report addresses biological resources that may be affected by the construction, operation, maintenance, or abandonment of components of the WyCoalGas coal gasification project. The need for this separate document arises from the CEQ guidelines which limit the final EIS to a discussion of only those impacts which are anticipated to be "significant."

The report is organized into two major sections: Affected Environment and Environmental Consequences. These sections describe the terrestrial and aquatic biological resources in the project area, and the biological impacts which would be anticipated to result from project implementation, respectively.

Discussions in each section are organized by project component and consider vegetation, terrestrial wildlife, aquatic biota, and threatened and endangered species. All biological data upon which impacts are assessed in this document were collected from state and federal resource agencies, technical libraries and literature, and regional authorities, prior to July 1981.

1.A VEGETATION

Baseline vegetation data were collected from the U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Soil Conservation Service, Wyoming Agricultural Experiment Station, Wyoming Natural Heritage Program, Wyoming Department of Environmental Quality, U.S. Bureau of Land Management, and published reports. Data collected describe the

species composition and forage production of major vegetation types in the project area.

Vegetation types which would be affected by the proposed action were analyzed using aerial photography (scale 1:80,000). This technique allows for the delineation of the following vegetation types:

- Prairie grassland
- Ponderosa pine forest
- Dry stream bottom type
- Plains cottonwood type
- Playa grassland

Total permanently and temporarily disturbed acreages in each vegetative habitat type were tabulated for each project component. In the grassland type, a major concern is the project-related loss of range grazing capacity. The significance of such losses was evaluated in terms of animal unit months (AUMs). From existing data, a range of estimated AUMs of each affected vegetation type was compiled. Since precise, site-specific estimates are not available, data collected near the project area or from more distant locations with similar range conditions were utilized. Estimates of AUMs permanently and temporarily lost for each project component were tabulated.

Any impact which would be detectable beyond five years of the initial period of disturbance was considered long term. Significance of impacts to vegetation was assessed individually by type, degree, and permanency of the disturbance. Because of the paucity of riparian vegetation (plains cottonwood type) in the project region (less than 5 percent) (BLM 1979), any disturbance which would alter or destroy this type was considered significant and long term. Any possible loss of

individuals or populations of _Rorippa calycina_ or _Gaura neomexicana_ spp. _coloradensis_ (federal "status review" plant taxa) was considered long term and significant.

Impacts to prairie grassland and other vegetation types were also assessed in terms of their value as wildlife habitat. Project-related losses of prairie grassland vegetation would not be significant in terms of forage or rare plant species. Assuming a successful reclamation plan, most vegetation-related impacts in the linear corridors would be short term. Losses of vegetation at permanent facilities, on the other hand, were considered long term. Vegetation types in the project area are mapped on Figure 1.

1.B TERRESTRIAL WILDLIFE

Baseline terrestrial wildlife data were collected from the Wyoming Game and Fish Department, U.S. Soil Conservation Service, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, Colorado Division of Wildlife, U.S. Forest Service, and published reports. These data characterize the fauna of eastern Wyoming and northeastern Colorado. Generally, these data describe the abundance and distribution of big game species; small game species; upland game birds; threatened, endangered, and rare species; raptors; waterfowl; furbearers; predators; and other nongame species.

A list of terrestrial vertebrate species potentially affected by the proposed action was developed from existing data (Appendix A). Typically, concern centers around game species and rare wildlife. Consequently, most of the terrestrial effort was concerned with describing and locating components of the environment that are essential for the maintenance of existing populations of these species. Removal

[in preparation]

Figure 1. Natural Vegetation Types

or alteration of these environmental components could result in depletion or, in some instances, a substantial reduction in the population.

A long-term impact to terrestrial wildlife would be detectable beyond five years of the initial perturbation. Any impact to a federally designated threatened or endangered species or state-designated rare, threatened, or endangered species was considered significant and, at least in the case of federally protected wildlife, long term, although such impacts could be localized. Any impacts to big game or upland game bird "critical habitat" were considered significant and, depending upon the permanency of the impact, could be considered either short or long term. Any permanent facility which restricts big game migration was considered to have a significant and long-term impact. Significant wildlife resources and habitats are mapped on Figure 2.

1.C AQUATIC BIOLOGY

Tables identifying proposed stream and river construction locations are presented throughout the Affected Environment section (Chapter 2). Where in-river construction (e.g., pipeline crossing, intake structure) would require individual permits, the appropriate water body is designated by a numerical superscript identifying the permits required.

In all phases of aquatic impact analysis, emphasis was placed on fishes, macroinvertebrates, and sensitive classification species. Other components of the freshwater community--including phytoplankton, zooplankton, periphyton, and vascular plants--are considered only in the few situations where anticipated impacts could significantly affect their populations. The high and rapid reproductive potential of plankton and periphyton populations should make them resistant to

[in preparation]

Figure 2. Animal Habitats

both short- and long-term construction and operation impacts. Vascular plants may be affected by direct removal from riverbeds due to construction of project components, but it is anticipated that, generally, these impacts will not be significant to a population level.

Short-term (or temporary) aquatic impacts were considered to be those biological disturbances which would be detectable for a period of five years or less. Long-term impacts would be detectable for more than five years. Intermittent impacts are treated as short-term, recurring biological disturbances.

Impacts were considered localized when they are anticipated to be confined to the physically disturbed stream crossing right-of-way and the downstream area where disturbed sediments or other materials are carried by natural currents. Aquatic biological impacts were considered "extensive" when they affect the biota or habitats of a larger area than defined above.

Aquatic impacts were considered insignificant if they were expected, as a direct or indirect result of project construction, operation, maintenance, or abandonment, to kill or displace few (or no) fishes or macroinvertebrates not considered to be sensitive classification species. Impacts were considered significant when they were anticipated to kill or displace numerous fishes or macroinvertebrates, whether or not they are sensitive classification species, as a direct or indirect result of project construction, operation, maintenance, or abandonment. Impacts were considered severe when they were anticipated to kill or permanently displace populations of fishes or macroinvertebrates as a direct or indirect result of project construction, operation, maintenance, or abandonment.

In the assessment of impacts, an attempt was made, where possible, to estimate the period of time required for habitat and population recovery from the identified impacts.

1.D THREATENED AND ENDANGERED SPECIES

The initial approach in reviewing potentially affected endangered and threatened species was to consider: those organisms that have been listed, or have been proposed for listing, as threatened or endangered by the U.S. Fish and Wildlife Service; those organisms which have been listed, or have been proposed for listing, as threatened, endangered, rare, peripheral, or given any other protected status by any state agencies; and species that appropriate federal and state agency personnel have indicated may be included in lists within the next several years. These species are listed in Appendix B.

Definitions of terms used in the report as they relate to the status of the species are given here.

Endangered

Endangered species means any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the Secretary of the Interior to constitute a pest whose protection under the provisions of the Endangered Species Act would present an overwhelming and overriding risk to man (P.L. 93-205, Endangered Species Act 1973).

Threatened

Threatened species means any species which is likely to become an endangered species within the foreseeable future throughout all

or a significant portion of its range (P.L. 93-205, Endangered Species Act 1973).

Threatened by Similarity of Appearance

The Secretary of the Interior may classify any species as an endangered or threatened species, even though it is not listed pursuant to Section 4 of the Endangered Species Act, if the Secretary finds that: (1) such species so closely resembles in appearance, at the point in question, a species which has been listed that enforcement personnel would have substantial difficulty in differentiating between the listed and unlisted species; (2) the effect of this substantial difficulty is an additional threat to an endangered or threatened species; and (3) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of the Endangered Species Act (P.L. 93-205, 1973).

Proposed

Under subsection 553(2) of Title 5, United States Code, the Secretary of the Interior, within 90 days of the receipt of the petition of an interested person, can conduct and publish in the Federal Register a review of the status of any listed or unlisted species proposed to be removed from or added to the endangered and threatened species lists, if the Secretary publishes a finding that such person has presented substantial evidence which warrants such a review. Further details of the review process are provided in P.L. 93-205 (Endangered Species Act 1973).

Notice of Review

The Secretary of the Interior may not add species to, or remove such species from, any published list unless the Secretary has

first: (1) published notice in the <u>Federal Register</u> and notified the Governor of each state within which such species is then known to occur that such action is contemplated; (2) allowed each such state 90 days after notification to submit its comments and recommendations, except to the extent that such period may be shortened by agreement between the Secretary and the Governor(s) concerned; and (3) published in the <u>Federal Register</u> a summary of all comments and recommendations received by him which relate to such proposed action (P.L. 93-205, Endangered Species Act 1973).

<u>Status Review</u>

The status of many species is currently being reviewed by the U.S. Fish and Wildlife Service. If the U.S. Fish and Wildlife Service finds sufficient cause to suspect that such a species is actually threatened or endangered, the species will then be proposed for inclusion in the federal list, following procedures stated in P.L. 93-205. During the status review process, the U.S. Fish and Wildlife Service may solicit data from other sources to aid in their decision.

CHAPTER 2
AFFECTED ENVIRONMENT

2.A COAL GASIFICATION PLANT AND ASSOCIATED FACILITIES

2.A.1 COAL GASIFICATION PLANT

Vegetation

The proposed coal gasification plant would occupy a site containing 3,372 acres of prairie grassland and 310 acres of agricultural lands (pastureland); actual plant facilities would be built on 815 acres of prairie grassland within this site (Figure 1).

The prairie grassland habitat type described throughout this document is a combination of the shortgrass and mixed prairie natural vegetation types described by Dorn (1977). Areas dominated by shortgrass species (i.e., *Buchloe dactyloides*, *Bouteloua gracilis*, *Koeleria macrantha*, and *Carex filifolia*) are typical of more flat plains which receive moderate to heavy grazing pressure. Mixed prairie species (i.e., *Andropogon* spp., *Agropyron* spp., *Bouteloua curtipendula*, and *Stipa* spp.) occur in areas of rougher topography and generally exist in the "mixed" state as a result of less grazing pressure. The proposed plant site is dominated by shortgrass species.

For the most part, these grasslands occur on shallow clayey (SwCy), shallow sandy (SwSy), and shallow loamy (SwLy) range sites, all of which usually occur on steep slopes and ridge tops, but may occur on all slopes in the 10 to 14 inch Northern Plains precipitation zone (U.S. Soil Conservation Service 1977).

On shallow clayey range sites, the climax plant community is typically dominated by midgrasses. Potential vegetation is about 80 percent grasses and grasslike species, 10 percent forbs, and 10 percent woody plants. Major plant species and their distribution on such sites are presented in Table 2-1. Approximate ground cover on shallow clayey range sites is 15 to 25 percent, and as range conditions deteriorate, big sagebrush and birdsfoot sagebrush become more dominant. Broom snakeweed and annuals are typical invaders (U.S. Soil Conservation Service 1977). Total annual production is approximately 1,200 lbs/acre during favorable years, 900 lbs/acre during median years, and 450 lbs/acre during unfavorable years. These sites usually provide good year-round forage for cattle, sheep, horses, and wildlife.

On shallow sandy range sites, the climax plant community is typically dominated by tall and midgrasses with potential vegetation being comprised of 70 percent grasses and grasslike plants, 15 percent forbs, and 15 percent woody plants. Major plant species and their distribution on such sites are shown in Table 2-2. Approximate ground cover ranges from 15 to 25 percent, and as range conditions deterirate, threadleaf sedge and fringed sagewort become more prevalent. Typical invaders include broom snakeweed and annuals. Total annual production in favorable years is approximately 1,400 lbs/acre, in median years total annual production is roughly 1,000 lbs/acre, and in unfavorable years it is 600 lbs/acre (U.S. Soil Conservation Service 1977). Shallow sandy sites provide good year-round forage for cattle, sheep, wildlife, and horses.

On shallow loamy range sites, the climax plant community is dominated by midgrasses, and potential natural vegetation is typically about 80 percent grasses and grasslike species, 10 percent forbs, and 10 percent woody plants. Major plant species and their distribution on such sites are presented in Table 2-3. The approximate ground

TABLE 2-1

MAJOR PLANT SPECIES AND PERCENTAGE OF THE TOTAL PLANT COMMUNITY ON SHALLOW CLAYEY (SwCy) RANGE SITES IN THE 10-14 INCH NORTHERN PLAINS PRECIPITATION ZONE, WYOMING

Species	Percent
Rhizomatous wheatgrasses	20-40
Western wheatgrass	
Thickspike wheatgrass	
Green needlegrass	20-40
Bluebunch wheatgrass	5-15
All following grasses and grasslike species combined	5-25
Canby bluegrass	
Cusick bluegrass	
Blue grama	
Hairy grama	
Sandberg bluegrass	
Plains reedgrass	
Stoneyhills muhly	
Buffalo grass	
Prairie junegrass	
Needleleaf sedge	
Threadleaf sedge	
All following forbs combined	5-10
American vetch	
Prairie clover	
Prairie coneflower	
Bluebells	
Penstemon	
Common comandra	
Aster	
Biscuitroot	
Fleabane	
Mountain thermopsis	
Onions	
Pussytoes	
Scurfpea	
Buckwheat	
Western yarrow	
Hawksbeard	
Two-grooved milkvetch	
Winterfat	Trace-5
Big sagebrush	Trace-5
Birdsfoot sagebrush	Trace-5

Source: U.S. Soil Conservation Service 1977.

TABLE 2-2

MAJOR PLANT SPECIES AND PERCENTAGE OF THE TOTAL PLANT COMMUNITY ON SHALLOW SANDY (SwSy) RANGE SITES IN THE 10-14 INCH NORTHERN PLAINS PRECIPITATION ZONE, WYOMING

Species	Percent
Needle-and-thread	10-25
Prairie sandreed	10-25
Sideoats grama	5-10
Sand bluestem	5-10
Bluebunch wheatgrass	5-10
Indian ricegrass	5-10
Little bluestrem	5-10
Blue grama	5-10
All following grasses and grasslike species combined Sandberg bluegrass Stoney hills muhly Sand dropseed Prairie junegrass Threadleaf sedge	5-10
All the following forbs combined Penstemon Prairie clover American vetch Groundsel Bluebell Dotted gayfeather Cudweed sagewort Scurfpea Western yarrow Pussytoes Hood's phlox Tailcup lupine Stonecrop Mountain thermopsis Nailworts Buckwheat Common comandra Green sagewort Skeleton plant Clematis Sandwort Yucca Fringed sagewort	5-15
Fourwing saltbush	5-10
All following woody plants combined Winterfat Silver sagebrush Low rabbitbrush Big sagebrush Skunkbush sumac	5-15

Source: U.S. Soil Conservation Service 1977.

TABLE 2-3

MAJOR PLANT SPECIES AND PERCENTAGE OF THE TOTAL PLANT COMMUNITY ON SHALLOW LOAMY (SwLy) RANGE SITES IN THE 10-14 INCH NORTHERN PLAINS PRECIPITATION ZONE, WYOMING

Species	Percent
Rhizomatous wheatgrasses	5-15
Western wheatgrass	
Thickspike wheatgrass	
Bluebunch wheatgrass	25-50
Needle-and-thread	5-10
Little bluestem	5-10
Blue grama	5-10
Threadleaf sedge	5-10
All the following grasses and grasslike species combined	5-15
Sideoats grama	
Indian ricegrass	
Cusick bluegrass	
Green neddlegrass	
Stoney hill muhly	
Hairy grama	
Sandberg bluegrass	
Plains reedgrass	
Prairie junegrass	
Red threeawn	
All the following forbs combined	5-10
American vetch	
Prairie clover	
Prairie coneflower	
Bluebell	
Biscuitroot	
Indian breadroot	
Scurfpea	
Tailcup lupine	
Hoods phlox	
Pussytoes	
Locoweed	
Mountain thermopsis	
Stonecrop	
Gromewell	
Western wallflower	
Common comandra	
Western yarrow	
Fleabane	
Fringed sagewort	
Winterfat	Trace-5
All the following woody plants combined	5-10
Skunkbush sumac	
Big sagebrush	
Silver sagebrush	
Yucca	
Rabbitbrush	

Source: U.S. Soil Conservation Service 1977.

cover on these range sites is 15 to 25 percent and as range condition deteriorates, blue grama and threadleaf sedge become more dominant. Typical invaders of deteriorated shallow loamy range sites include broom snakeweed, cactus, and annuals (U.S. Soil Conservation Service 1977). Total annual production in favorable years is approximately 1200 lbs/acre; during median and unfavorable years production is 900 and 450 lbs/acre, respectively. These sites provide good year-round forage for cattle, sheep, wildlife, and horses.

The production of range beef cattle and sheep is the predominant agricultural land use in the vicinity of the proposed plant. Correct stocking densities of domestic animals are important for the perpetuation of the range. Stoddart, Smith, and Box (1975) defined range grazing capacity as "the maximum animal number which can graze each year on a given area of range for a specific number of days without inducing a downward trend in forage production, forage quality, or soil." In practice, grazing capacity on a given range is reported in animal unit months (AUMs). An AUM is the amount of forage needed to support 1,000 lbs of live animal weight for a month (Stoddart and Smith 1955). The actual number of animals which make up this 1,000 lb animal unit month base are listed by Stoddart, Smith, and Box (1975) as: 1 cow and unweaned calf, 5 sheep, 7.7 white-tailed deer, 9.6 pronghorn antelope, 1.9 elk, or 5.8 mule deer. The U.S. Soil Conservation Service's suggested stocking rates in the 10 to 14 inch Northern Plains precipitation zone vary, as shown in Table 2-4, from 0.2 AUM/acre on ranges in excellent condition to 0.05 AUM/acre on ranges in poor condition.

According to a study performed by the Missouri River Basin Commission (1959) between 1956 and 1959, a 240-acre tract in R. 70 W., T. 35 N., sec. 21, in the northeast corner of the proposed plant site supported 0.2 AUM/acre. A 120-acre tract just west of Highway 59 (R.

TABLE 2-4

INITIAL STOCKING RATES (AUMs/acre) IN THE 10-14 INCH NORTHERN PLAINS PRECIPITATION ZONE

Range Site	Range Condition (percent original vegetation) Excellent (76-100)	Good (51-75)	Fair (26-50)	Poor (0-25)
Wetland	3.0	2.5	1.5	1.0
Subirrigated	2.0	2.5	1.0	0.6
Saline Subirrigated	1.5	1.2	0.8	0.4
Lowland	0.6	0.5	0.25	0.15
Overflow	0.6	0.5	0.25	0.15
Clayey Overflow	0.6	0.5	0.25	0.15
Saline Lowland	0.5	0.4	0.15	0.1
Sands	0.4	0.3	0.2	0.1
Sandy	0.4	0.33	0.2	0.1
Loamy	0.4	0.33	0.2	0.1
Clayey	0.4	0.33	0.2	0.1
Dense Clay	0.3	0.25	0.15	0.07
Shallow Sandy	0.2	0.17	0.1	0.05
Shallow Loamy	0.2	0.17	0.1	0.05
Shallow Clayey	0.2	0.17	0.1	0.05
Saline Upland	0.15	0.12	0.05	0.03
Very Shallow	0.15	0.12	0.05	0.03
Shale	0.15	0.12	0.05	0.03

Source: Loeper 1981.

71 W., T. 35 N., sec. 5) supported 0.33 AUM/acre. Another site just south of the proposed plant location (R. 70 W., T. 34 N., sec. 7) had a grazing capacity of 0.25 AUM/acre (Missouri River Basin Commission 1959). Presently this prairie grassland and range supports approximately 0.2 AUM/acre (Loeper 1981). By multiplying the grazing capacity (0.2 AUM/acre) by the total grazable acres or prairie grassland on the proposed plant site (3,372 acres), it was calculated that approximately 675 AUMs could exist on the proposed plant site. The 310 acres of improved pastureland could probably support 0.5 AUM/ acre, contributing an additional 55 AUMs to the proposed plant site. The total AUMs on the 3,682-acre plant site is roughly 830.

Terrestrial Wildlife

Wildlife species that could occur in the vicinity of the proposed coal gasification plant and its associated facilities are listed in Appendix A (Tables A-1, A-2, and A-3). These lists were compiled from distribution data provided by Long (1965), Oakleaf et al. (1979), and Baxter and Stone (1980).

Big Game. The proposed coal gasification plant site is year-round habitat for mule deer and pronghorn antelope. Elk and white-tailed deer are not expected to occur near the proposed plant site. According to the Wyoming Game and Fish Department (1980a), no critical habitat for big game exists in the vicinity of the proposed plant site.

The proposed plant site lies roughly within the boundaries of the Lance Creek mule deer herd unit (Wyoming Game and Fish Department 1978). Essentially all areas occupied within the Lance Creek unit provide year-round habitat. During winter, especially during periods of heavy snow, the mule deer in this herd tend to congregate along drainages. The herd size is estimated at 10,000 animals (Wyoming Game and Fish Department 1978). During the 1979 hunting season 2,130 mule

deer were harvested from this herd (Wyoming Game and Fish Commission 1980b).

During the winter, mule deer consumption of woody plants increases due to the lack of other available forage; sagebrush, antelope bitterbrush, mountain mahogany, and rabbitbrush all become important in the diet (Strickland 1975). Generally willow, huckleberries, shrubby cinquefoil, and buffaloberry are important in the summer diet, as are a variety of forbs. Grass and grasslike plants are relatively unimportant as a good source (Strickland 1975).

Antelope probably range across the entire proposed plant site, except in agricultural areas, and are undoubtedly the most common big game animal in the area. Antelope are an important game species, second only to mule deer in total numbers annually harvested in Wyoming. In 1979, 48,798 licensed hunters spent 107,078 total hunter days to harvest 44,616 antelope in Wyoming (Wyoming Game and Fish Department 1980b). Hunter success for antelope during the 1979 season was 91.4 percent.

In 1970, about 79 percent of the total estimated number of pronghorns in North America (435,329) were located in the region of southern Alberta and Saskatchewan, western North and South Dakota, Montana, and Wyoming (Sundstrom et al. 1973). This general area appears to provide a particular combination of biotic and physical factors that are most favorable for antelope and was termed the "zone of maximum abundance" by Kendeigh (1961). Wyoming, Colorado, Idaho, Montana, Nevada, Oregon, and South Dakota supported 83 percent of North America's antelope in 1970.

Although pronghorns generally occupy grassland habitats (Sundstrom et al. 1973), the majority of their diet consists of browse and

forb species. Sundstrom et al. (1973) reported that in over 900 rumens examined from the zone of maximum abundance, 64 percent of the rumen was browse, of which 73 percent was sagebrush. The degree of browse preference varies with season and availability. When fall and winter snows cover low-growing forage in the northern range, browse becomes of critical importance. According to Sundstrom et al. (1973), big sagebrush, silver sagebrush, black sagebrush, sand sagebrush, Douglas rabbitbrush, rubber rabbitbrush, antelope bitterbrush, and western snowberry are the major browse species utilized. Forbs appear to be of critical importance for antelope survival on the more southerly ranges (Sundstrom et al. 1973) and, depending upon the season, make it possible for antelope to be less dependent on the sometimes limited water supplies.

Grass is of minor importance in the diet of pronghorns; usually grass averages less than 10 percent of the rumen content on an annual basis (Sundstrom et al. 1973). Sundstrom et al. (1973) reported grass to be the least preferred forage used by pronghorn. However, grass may be important on a short seasonal basis. In early spring when grasses are the only available green succulent forage, grass content of the rumen may be as high as 32 percent. Major grass species used are western wheatgrass, needle-and-thread, and Sandberg bluegrass (Sundstrom et al. 1973).

Environmental factors (i.e., climate, available water, and favorable forage) determine antelope reproductive success and consequently population levels. In areas within the range of big sagebrush and silver sagebrush, antelope have long-term averages of 79 to 100 fawns per 100 does (Sundstrum et al. 1973). The highest annual production is associated with precipitation of approximately 11 inches.

Upland Game Birds. According to Oakleaf et al. (1979), the following upland game birds occur in the area that would contain the coal gasification plant: blue grouse (*Dendragapus obscurus*), sage grouse (*Centrocercus urophasianus*), ring-necked pheasant (*Phasianus colchicus*), chukar (*Alectoris chukar*), gray partridge (*Perdix perdix*), and turkey (*Meleagris gallopavo*).

Aerial surveys conducted in April 1981 and data from the Wyoming Game and Fish Department (1980a) revealed that no known sage grouse leks occur in the vicinity of the proposed plant site. Sage grouse hunting pressure in Converse County, Wyoming, is relatively light. In 1979, an estimated 215 hunters spent 394 days taking 444 sage grouse (Wyoming Game and Fish Department 1980c). Continued establishment of new coal strip mines and oil wells is decreasing the amount and quality of sage grouse habitat in Converse County (Fitzgerald 1981).

Turkey populations are increasing in Converse County; however, their present distribution is limited to the eastern portion of the Laramie Range and deciduous riparian areas (Fitzgerald 1981). Turkeys would not be expected to occur on the proposed plant site due to lack of sufficient roosting habitat, cover, and forage.

The only known blue grouse population in Converse County occurs in forested areas in the southern portion of the county south of the North Platte River (Fitzgerald 1981). Robbins et al. (1966) list summer habitat for blue grouse as deciduous woodlands; winter habitat is typically mountain thickets of fir. Consequently, blue grouse would not be expected to occur on the proposed coal gasification plant site.

Ring-necked pheasants, chukar, and gray partridge in Wyoming are typically encountered in croplands and riparian habitats (Oakleaf et

al. 1979). All of these species can be locally abundant on agricultural lands, especially in fields under irrigation. The lack of suitable habitat on the plant site precludes the occurrence of these birds.

Waterfowl. Waterfowl species observed in the area containing the proposed plant site and associated facilities are listed in Appendix A, Table A-2. Because of the intermittent nature of Little Lightning, Walker, and Willow creeks, little if any waterfowl habitat exists on the proposed site.

Raptors. According to aerial surveys conducted in April and May 1981 and data provided by the Wyoming Game and Fish Department (1980a), no known eagle or buteo nests occur on the proposed plant site. However, several species of raptors occur in the vicinity of the proposed plant site (Appendix A, Table A-2), and many probably hunt in the area.

Lagomorphs and Small Mammals. August trapping on the proposed plant site revealed a density of 9.7 small mammals per acre, of which 63 percent were deer mice (Peromyscus maculatus) (WyCoalGas 1974). Other species collected from the plant site vicinity include the thirteen-lined ground squirrel (Spermophilus tridecemlineatus), northern grasshopper mouse (Onychomys leucogaster), prairie vole (Microtus orchogaster), sagebrush vole (Lagurus curtatus), and olive-backed pocket mouse (Perognathus fasciatus) (Ecology Consultants, Inc. 1975a, b).

Lagomorph density estimates were determined on the plant site from night spotlight surveys during June 1975 (Ecology Consultants, Inc. 1975a). The population estimates were as follows: cottontails (Sylvilagus sp.) 7 per square mile (sq mi); white-tailed jackrabbit (Lepus townsendii), 53/sq mi; and black-tailed jackrabbit (Lepus

californicas), 21/sq mi. The estimates total 71 lagomorphs per square mile, or 0.1/acre on the plant site.

Aquatic Biology

The aquatic habitat on the proposed coal gasification plant site is limited to three intermittent streams: Little Lightning and Willow creeks, and an unnamed tributary of Walker Creek. Ecology Consultants, Inc. (1975a, b) reported that a field reconnaissance during May 1975 found no standing or flowing water. Furthermore, they reported that the heaviest precipitation is during the spring and that there was heavier than normal precipitation during that particular spring; they concluded that "little or no aquatic habitat exists on the plant site."

Threatened and Endangered Species

The U.S. Fish and Wildlife Service, in compliance with Section 7 of the Endangered Species Act, has supplied a list of federal endangered and threatened species that could occur in the vicinity of project components. Plants and animals under status review, proposed, or listed as threatened, endangered, or rare in Wyoming, are listed in Appendix B. No federally listed, proposed or status review plant taxa are known to occur in the vicinity of the proposed plant.

The black-footed ferret (Mustela nigripes) is endangered throughout its entire range, as reported in the Federal Register (32 FR 4001, March 11, 1967; and 35 FR 8495, June 2, 1970). The original range of the black-footed ferret extended from Saskatchewan and Alberta, Canada to Texas, New Mexico, and Arizona, thus closely coinciding with the distribution of prairie dogs (Cynomys spp.) (Hall and Kelson 1959). Recent evidence reported by Clark (1978) indicated the ferret probably occurred further west (in Wyoming) than Hall and Kelson reported, and this evidence has been confirmed

by discovery of skeletal remains in southwest Wyoming (Martin and Schroeder 1978).

The ferret was found throughout the Great Plains, mountain basins, and semiarid grasslands of North America (Hill and Kelson 1959). The ferret is believed to be characteristic of the short and midgrass prairie grasslands, and Clark (1978) indicates that 97 percent of ferret sightings in Wyoming (n=105) were in a sagebrush/grassland vegetation type. Even though ferrets have been reported from haystacks, under buildings, and in ground squirrel colonies, the majority of evidence indicates that their principal habitat is prairie dog colonies (Hershkovitz 1966; Hillman 1968; Snow 1972a; Clark 1975; Black-footed Ferret Recovery Team 1978; Clark 1978).

Many authors indicate that ferrets and prairie dogs have been and still remain in close association (Hall and Kelson 1959; Hershkovitz 1966; Hillman 1968; Snow 1972a; Clark 1975; Black-footed Ferret Recovery Team 1978; Clark 1978. Hillman (1968) indicated that ferrets were observed to feed entirely on prairie dogs even when other potential prey species were available. The prairie dog reproductive potential apparently offsets any effect the predation may have, though this is somewhat dependent on prairie dog town size (Hillman 1968). Prairie dog burrows also provide shelter and denning habitat for the ferret (Hillman 1968).

The presence or absence of the black-footed ferret in any area is very difficult to determine. Even surveys and searches may be inconclusive, and all that may be stated is that a ferret or ferret sign was or was not found on the dates searched. Many of the historical observations are very old reports and some observations are questionable. Even recent observations are frequently questioned because some have been made by individuals with no field training, some were brief

and failed to provide a good description, photographs or specimens have not always been available, and so on.

Some reports have indicated that ferrets were probably never common; such reports may be the result of a scarcity of population data and the apparent difficulty of observing ferrets. They are primarily nocturnal and spend most of their life underground. Ferrets may at one time have been somewhat more abundant than earlier reports indicated (Black-footed Ferret Recovery Team 1978). For example, at least 44 ferrets were mentioned in U.S. Bureau of Biological Survey reports filed at Pierre, South Dakota, during the seven-year period from 1923 to 1929. Linder et al. (1972) indicated that ferrets must therefore have been, if not abundant, at least "not uncommon."

Several factors have probably contributed to the reduction in black-footed ferret numbers. Natural predators, parasites, diseases, human-related deaths (e.g., automobiles, domestic pets), shooting, land use changes, and prairie dog eradication programs have all been mentioned as possible contributing factors (Hillman 1968; Linder et al. 1972; Snow 1972a; Black-footed Ferret Recovery Team 1978; Clark 1978). Control and eradication programs conducted by government agencies have certainly reduced prairie dog populations within much of their former range. For example, Clark (1978) estimated that in Wyoming prairie dog populations have been reduced by at least 75 percent. The various prairie dog control programs have undoubtedly had an effect on black-footed ferrets. Poisoning prairie dogs reduces the available ferret food supply; certain chemical compounds and poison gases could affect ferrets as well as prairie dogs.

According to Clark (1973), 8,230 acres in Converse County, Wyoming, are occupied by black-tailed prairie dogs. Consequently, there are 8,230 acres of potential ferret habitat in Converse County.

Clark (1973) reported only one black-footed ferret sighting in the county between 1851 and 1973, this sighting occurred in Douglas in 1917. An aerial survey conducted in April 1981 revealed that potential black-footed ferret habitat (prairie dog towns) does not exist in the vicinity of the proposed plant site. Consequently, the black-footed ferret is not expected to occur on the plant site.

The bald eagle (Haliaeetus leucocephalus) is classified as endangered in all the conterminous states except Washington, Oregon, Maine, Wisconsin, and Minnesota, and is listed as threatened in those five states, as published in the Federal Register (32 FR 4001, March 11, 1967; and 43 FR 6233, February 14, 1978). The bald eagle formerly bred throughout much of the United States; now it breeds primarily in the northern states and in Florida. During the winter the bald eagle occurs along many bodies of water, especially larger rivers and lakes, throughout eastern Wyoming and northeastern Colorado.

The bald eagle is primarily a fish-eater, but it also consumes carrion and will catch crippled waterfowl. Nests are usually built in tall trees and are renovated yearly. Eagles defend their nesting territories but do not defend any territory during migration or winter (Snow 1973a). Large numbers of bald eagles have been reported to gather at communal roosts, usually near a food source or shelter (Snow 1973a). There are no known bald eagle nests or roosts in the vicinity of the proposed plant site (Wyoming Game and Fish Commission 1980a).

The American peregrine falcon (Falco peregrinus anatum) occurs in Canada, the United States, and Mexico; and the Arctic peregrine falcon (F. p. tundrius) occurs from Alaska to Greenland and south to South America. Both subspecies are classified as endangered throughout their entire range, as published in the Federal Register (35 FR 16047, October 13, 1970; 35 FR 8495, June 2, 1950; and 35 FR 18320, December 2, 1970).

The peregrine falcon formerly bred and wintered throughout most of North America, with the primary exception being the Southeast. This falcon still breeds throughout much of the West but is fairly rare in the East.

Most peregrine falcon nests are located on cliffs, particularly ones that are extremely high, overlook water, and offer an extensive view. Not all such cliffs are presently occupied, nor have they historically been occupied. An adequate food supply in the vicinity of the nest location is also a necessity. Nesting sites are normally reused yearly (Snow 1972b).

The peregrine's principal diet consists of passerine birds, waterfowl, and shorebirds. Mated pairs may hunt together, with one bird flushing the prey while the other bird waits to capture it (Snow 1972b).

Williams and Matteson (1973) stated that the peregrine falcon is not common as a summer resident in Wyoming but is more frequently encountered as a migrant. Suitable peregrine falcon nesting habitat is lacking in the vicinity of the proposed plant site (Wyoming Game and Fish Department 1980a).

2.A.2. WATER SUPPLY SYSTEM

North Well Field

Vegetation. The lease boundaries of the North Well Field would include 20,777 acres of prairie grassland and 63 acres of pastureland (Figure 1), whose characteristics have been discussed in Section 2.A.1. The Missouri River Basin Commission (1959) estimated grazing capacity for several tracts within or immediately adjacent to the

proposed North Well Field. These are presented in Table 2-5; estimates ranged from 0.18 to 0.33 AUM/acre. According to Loeper (1981), the area that includes the proposed North Well Field presently supports 0.2 AUM/acre. Therefore the entire North Well Field contains 4,168 total AUMs.

Actual acreages of vegetation removed by construction of the proposed gathering lines and associated surface facilities are listed in Table 2-6. Assuming a 50-foot corridor width for construction of the proposed gathering lines, construction would temporarily disturb 185.5 acres of prairie grassland and remove approximately 37 AUMs from production. Totals include the main line from the North Well Field to the proposed plant site.

Terrestrial Wildlife. Wildlife species that could occur in the vicinity of the proposed North Well Field are listed in Appendix A (Tables A-1, A-2, and A-3).

Big Game. The proposed North Well Field provides year-round habitat for mule deer and antelope. No critical big game habitat exists in the vicinity of the proposed well field (Wyoming Game and Fish Department 1980a). The biology and habitat requirements of these species have been described in Section 2.A.1.

Upland Game Birds. Oakleaf et al. (1979) reported the following upland game birds in the area that would contain the North Well Field: blue grouse, sage grouse, ring-necked pheasant, chukar, gray partridge, and turkey. April 1981 aerial surveys and data from the Wyoming Game and Fish Department (1980a) indicate that no known sage grouse leks occur in the vicinity of the North Well Field. The distribution of other upland game bird species in Converse County has been described in Section 2.A.1; none of these species are expected to nest in the proposed North Well Field.

TABLE 2-5

ANIMAL UNIT MONTH ESTIMATES FOR SELECTED PLOTS WITHIN OR ADJACENT TO THE PROPOSED NORTH WELL FIELD, CONVERSE COUNTY, WYOMING

Township, Range, and Section	Acres	Total AUMs for Plot	Estimated AUMs/Acre
T. 35 N., R. 70 W., Sec. 21	240.0	48	0.20
T. 35 N., R. 71 W., Sec. 5	120.0	40	0.33
T. 35 N., R. 71 W., Sec 18	32.87	10	0.30
T. 35 N., R. 71 W., Sec. 1	299.0	50	0.18
T. 35 N., R. 70 W., Sec. 1	120.0	40	0.33
T. 36 N., R. 70 W., Sec. 4	162.71	32	0.20
T. 36 N., R. 70 W., Sec. 4	162.5	32	0.20
T. 36 N., R. 71 W., Sec. 4	166.47	41	0.25
T. 34 N., R. 70 W., Sec. 7	121.25	30	0.25
T. 34 N., R. 71 W., Sec. 4	40.0	10	0.25

AUM estimates are from Land Classification Reports made by the Missouri River Basin field crew for the North Platte Area, Bureau of Land Management, 1956-1959.

TABLE 2-6

VEGETATION HABITAT TYPES REMOVED FROM PRODUCTION BY CONSTRUCTION OF GATHERING LINES AND ASSOCIATED FACILITIES IN THE NORTH WELL FIELD

Pipe Section	Pipeline Diameter (inches)	Distance (miles)	Acres	Vegetation Habitat Type
North Well Field 14 to 15	6	1.0	6.1	Prairie grassland
North Well Field 15 to 12	6	1.5	9.1	Prairie grassland
North Well Field 15 to 16 to 1-23	8	1.9	11.5	Prairie grassland
North Well Field 1-23 to Raw Water Facility	14	5.3	32.1	Prairie grassland
North Well Field 1-23 to 18	8	1.0	6.1	Prairie grassland
North Well Field 18 to 17 to 13	6	2.0	12.1	Prairie grassland
North Well Field 18 to 20	6	1.0	6.1	Prairie grassland
North Well Field 20 to 19	6	1.0	6.1	Prairie grassland
North Well Field 19 to 2	6	1.1	6.7	Prairie grassland
North Well Field 3 to 7	6	1.0	6.1	Prairie grassland
North Well Field 7 to 8	6	1.4	8.5	Prairie grassland
North Well Field 8 to Pump Station	6	0.6	3.6	Prairie grassland
North Well Field 11 to Pump Station	4	0.5	3.0	Prairie grassland
North Well Field 10 to 6"/4" Junction	6	0.4	2.4	Prairie grassland
6"/4" Junction to Pump Station	4	0.5	3.0	Prairie grassland
Pump Station to 9 to 24"/16" Junction	24	1.4	8.5	Prairie grassland
24"/16" Junction to Plant Site	16	5.7	34.5	Prairie grassland
North Well Field 4 to 5	6	1.5	9.1	Prairie grassland
North Well Field 6 to 5	6	1.0	6.1	Prairie grassland
North Well Field 5 to 16" Main Pipe	6	0.8	4.8	Prairie grassland
Total		30.6	185.5	

Waterfowl. Waterfowl species observed in the area that would contain the proposed North Well Field are listed in Appendix A, Table A-2. Streams which drain the proposed site are intermittent; consequently, little if any waterfowl habitat exists at the proposed North Well Field.

Raptors. Aerial surveys in May 1981 located two golden eagle nests in the vicinity of the North Well Field (Figure 2). No other known raptor nests occur in the vicinity of the North Well Field (Wyoming Game and Fish Department 1980a). However, several other raptor species occur in the area (Appendix A, Table A-2), and many probably hunt in the area.

Aquatic Biology. The proposed North Well Field would contain five intermittent streams, including Lightning and Little Lightning creeks as well as unnamed tributaries of Fetterman and Walker creeks and the North Platte River. Lightning, Little Lightning, and Walker creeks are within the Cheyenne River drainage, while the unnamed tributary to the North Platte River and Fetterman Creek is within the North Platte River drainage (Baxter and Simon 1970). None of these streams have been classified by the U.S. Fish and Wildlife Service or the Wyoming Game and Fish Commission (1978), but they are considered "Class 5" streams by the Wyoming Game and Fish Department (1977a). Such streams are considered to be low-production waters that are often incapable of sustaining a permanent fishery; sport fisheries are typically lacking in these streams. Table 2-7 describes the numerical stream classification systems used throughout this document.

While these intermittent streams would not typically support a permanent fish fauna, some fishes indigenous to the basin (Table 2-8) could occur, at least during periods of flowing water. Game fish include black bullhead, channel catfish, green sunfish, and bluegill.

TABLE 2-7

STREAM EVALUATION DEFINITIONS USED BY U.S. FISH AND WILDLIFE SERVICE AND WYOMING GAME AND FISH DEPARTMENT (1978) AND WYOMING GAME AND FISH DEPARTMENT (1977a)

U.S. Fish and Wildlife Service and Wyoming Game and Fish Department (1978)	
Value Class I	- Highest-value fishery resource
Value Class II	- High-priority fishery resource
Value Class III	- Substantial fishery resource
Value Class IV	- Limited fishery resource
Wyoming Game and Fish Department (1977a)	
Class 1	- Premium trout waters - fisheries of national importance
Class 2	- Very good trout waters - fisheries of statewide importance
Class 3	- Important trout waters - fisheries of regional importance
Class 4	- Low-production waters - fisheries frequently of local importance but generally incapable of sustaining substantial fishing pressure
Class 5	- Very low production waters - often incapable of sustaining a fishery

TABLE 2-8

FISHES OF THE CHEYENNE RIVER BASIN, WYOMING

Common Name	Scientific Name
Minnows and Carps	Family Cyprinidae
Golden shiner	Notemigonus crysoleucas
Flathead chub	Hybopsis gracilis
Longnose dace	Rhinichthys cataractae
Sand shiner	Notropis stramineus
Plains minnow	Hybognathus placitus
Fathead minnow	Pimephales promelas
Suckers	Family Catostomidae
River carpsucker	Carpiodes carpio
White sucker	Catostomus commersoni
Mountain sucker	Catostomus platyrhynchus
Catfishes	Family Ictaluridae
Black bullhead	Ictalurus melas
Channel catfish	Ictalurus punctatus
Killifishes	Family Cyprinodontidae
Plains topminnow	Fundulus sciadicus
Plains killifish	Fundulus kansae
Sunfishes	Family Centrarchidae
Green sunfish	Lepomis cyanellus
Bluegill	Lepomis macrochirus
Perches	Family Percidae
Plains orangethroat darter	Etheostoma spectabile pulchellum

Source: Baxter and Simon 1970.

The affected drainages within the North Platte basin are small intermittent or ephemeral streams. Fishes reported from the North Platte basin (North Platte River and its tributaries) are presented in Table 2-8. Not all of these fishes are expected to occur in the intermittent streams on the well field site. The shovelnose sturgeon, a large river fish (Baxter and Simon 1970), would not be expected in the well field streams. The gizzard shad, as of 1970, was known in Wyoming from a single specimen collected near Torrington (Baxter and Simon 1970); since 1970, the Wyoming Game and Fish Department (1979) has made additional collections in the North Platte River downstream from Guernsey Reservoir. Although its present range in the state is probably expanding, it seems unlikely that the gizzard shad would occur in the North Well Field. Although the northern pike was known from only one Wyoming locale in 1970 (Baxter and Simon 1970), the fish has subsequently been collected in the North Platte River (Wyoming Game and Fish Department 1979). However, because of the lack of permanent habitat, the northern pike would probably not occur in the North Well Field. Flathead chub, river shiner, quillback, river carpsucker, and northern redhorse prefer large rivers. However, small intermittent streams are often used for spawning by these and other species. During spring flow suckers probably spawn in the intermittent tributaries to the North Platte River. The walleye prefers large lakes and clear rivers. The remainder of the fishes listed on Table 2-8 might be found in the streams on the well field, if the streams have pools deep enough to maintain year-round habitat. Young-of-the-year and those fishes that spawn in the spring might use the downstream areas. As long as water is present, some fishes could forage in the streams.

The Cheyenne and North Platte river basins share some aquatic invertebrate taxa. Both drainages would be likely to include species of Protozoa, Turbellaria, Gastrotricha, Rotatoria, Nematoda,

Tardigrada, Oligochaeta, Cladocera, Copepoda, Ostracoda, Mollusca, Hydracarina, Amphipoda, Odonata, Hemiptera, Diptera, Coleoptera, Plecoptera, Ephemeroptera, and Trichoptera (Pennak 1966). The decapod fauna is impoverished primarily because the eastern species have encountered geographic barriers of shifting, silted rivers, and streams with high gradients. The high dispersal capabilities of the aquatic invertebrates would produce similar invertebrate faunas in the well field.

Threatened and Endangered Species. Federally protected species which could occur in the vicinity of the proposed North Well Field include the black-footed ferret, bald eagle, and peregrine falcon. The biology and habitat requirements of each of these species have been described in Section 2.A.1. April and May 1981 surveys revealed that black-footed ferret habitat (prairie dog towns) does not exist within the North Well Field lease boundary. Consequently the black-footed ferret is not expected to occur in the area. No known peregrine falcon or bald eagle nesting or roost sites exist on or near the proposed North Well Field (Wyoming Game and Fish Department 1980a). No federally listed, proposed, or status review plant taxa are expected to occur in the vicinity of the North Well Field.

South Well Field

Vegetation. The South Well Field is approximately 20,883 acres in size, and the natural vegetation is predominantly prairie grassland (Figure 1). Data provided by the Missouri River Basin Commission (1959) and Loeper (1981) suggest that prairie grassland in the proposed South Well Field presently supports 0.2 AUM/acre.

Actual acreages of vegetation removed by the construction of gathering lines and associated facilities are listed in Table 2-9.

TABLE 2-9

VEGETATION HABITAT TYPES THAT WOULD BE TRAVERSED BY WATER SUPPLY GATHERING LINES IN THE SOUTH WELL FIELD, CONVERSE COUNTY, WYOMING

Pipe Section	Pipeline Diameter	Distance	Acreage	Vegetation Habitat Type
Beginning in R74W, T32N, Sec. 3 to 8"/10" junction	8"	2.2 mi	13.3	Prairie grassland-12.7 acres Dry reservoir-0.6 acres
8"/10" junction to 18" pipe	10"	0.6 mi	3.6	Prairie grassland
Beginning in R74W, T32N, Sec. 1 to 10" junction	6"	0.8 mi	4.8	Prairie grassland
Beginning in R74W, T32N, Sec. 13 to 10" junction	8"	0.6 mi	3.6	Prairie grassland
10" pipe beginning in R74W, T32N, Sec. 12 to 10"/17" junction	10"	1.3 mi	7.9	Prairie grassland
8" pipe beginning in R73W, T32N, Sec. 8 to Chamberlain 3	8"	0.4 mi	2.4	Prairie grassland
Chamberlain 3 to 18" junction	10"	2.0 mi	12.1	Dry Reservoir-3.0 acres Prairie grassland-9.1 acres
Beginning in R73W, T33N, Sec. 32 to 18" junction	8"	0.5 mi	3.0	Prairie grassland
Beginning in R73W, T32N, Sec. 6	8"	0.1 mi	0.6	Prairie grassland
	Total	8.5 miles	51.3 acres	

Assuming a 50-foot right-of-way, construction of the gathering lines would disturb 477 acres of prairie grassland and 3.6 acres of dry reservoir bottom, resulting in a temporary loss of approximately 100 AUMs.

Terrestrial Wildlife. Wildlife species that could occur in the vicinity of the proposed South Well Field are listed in Appendix A (Tables A-1, A-2, and A-3).

Big Game. The proposed South Well Field provides year-round habitat for mule deer and antelope. No big game critical habitat exists in the vicinity (Wyoming Game and Fish Department 1980a). The biology and habitat requirements of these species have been described in Section 2.A.1.

Upland Game Birds. Oakleaf et al. (1979) reported the following game birds in the vicinity of the South Well Field: blue grouse, sage grouse, ring-necked pheasant, chukar, gray partridge, and turkey. April 1981 surveys of the proposed South Well Field and data from the Wyoming Game and Fish Department (1980a) revealed that sage grouse leks do not occur in the area. The distribution of other upland game bird species in Converse County has been discussed in Section 2.A.1. None of these species are expected to nest in the proposed South Well Field.

Waterfowl. Several small gully-plug reservoirs in the proposed South Well Field provide potential waterfowl habitat, and according to McKnight (1980) at least one reservoir on Little Box Elder Creek (R. 74 W., T. 33 N., sec. 36) receives seasonal use by geese. Other waterfowl that have been observed in the area that would contain the proposed South Well Field are listed in Appendix A, Table A-2.

Raptors. According to the Wyoming Game and Fish Department (1980a) and aerial surveys conducted in April and May 1981, no known eagle or buteo nests occur within the proposed South Well Field. The nearest nest occurs on the north end of LaPrele Reservoir. Several species of raptors occur in the vicinity of the proposed South Well Field latilong (Appendix A, Table A-2), many of which probably hunt in the area.

Aquatic Biology. The South Well Field is located within the North Platte River basin. Box Elder Creek, a perennial stream, flows through the site. In addition, the following intermittent streams are located in the well field: Buckshot Creek, Little Box Elder Creek, an unnamed tributary of the North Platte River, and LaPrele Creek.

LaPrele and Little Box Elder creeks have been classified as "Value Class III" by the U.S. Fish and Wildlife Service and Wyoming Game and Fish Commission (1978), which suggests that these streams maintain a substantial fishery resource. The remaining streams were considered "Class 5" by the Wyoming Game and Fish Department (1977a), indicating that they are very low production waters.

Fishes of LaPrele and Little Box Elder creeks have been surveyed by the Wyoming Game and Fish Department (1979) and are listed in Table 2-10. Fishing pressure on LaPrele Creek was reported as 40 fishermen days per year per mile, which is higher than average for streams of regional importance. The Wyoming Game and Fish Department (1979) estimated that LaPrele Creek supported 400 fishermen days per year. LaPrele Creek is presently being managed under the "basic yield" concept, the objective of which is to provide fishermen with the opportunity to harvest fish. Basic yield streams may or may not be stocked; if stocked, hatchery fry or fingerlings are used. LaPrele

TABLE 2-10

FISHES COLLECTED FROM LAPRELE AND LITTLE BOX ELDER CREEKS

Fish	LaPrele Creek	Little Box Elder Creek
Salmonidae (Trouts)		
Salmo gairdneri (Rainbow trout)	X	X
Salmo trutta (Brown trout)	X	
Salvelinus fontinalis (Brook trout)		X
Cyprinidae (Minnows)		
Cyprinus carpio (Carp)	X	
Catostomidae (Suckers)		
Catostomus commersoni (White sucker)	X	
Catostomus catostomus (Longnose sucker)	X	

Source: Wyoming Fish and Game Department 1979.

Creek is stocked at present, but it is not managed for trophy, unique species, or wild fish.

Little Box Elder Creek is an important trout stream in the area (Wyoming Game and Fish Department 1979). This 3-mile-long stream supports 5 fishermen days per year per mile. It is managed under the basic yield concept, as described for LaPrele Creek, but as of 1979 there was no stocking activity.

It is assumed that the other streams in the proposed South Well Field would include similar fish faunas, although they have not been surveyed.

There are several unnamed permanent pools in the proposed South Well Field. They have not been surveyed by the Wyoming Game and Fish Department (1979), but most likely support populations of minnows, catfish, and sunfish.

The aquatic macroinvertebrates expected to dominate the LaPrele and Little Box Elder creek faunas include various Ephemeroptera, Trichoptera, Diptera, Coleoptera, Odonata, Hemiptera, and Mollusca. The pond macroinvertebrate fauna would be dominated by various oligochaetes and dipterans (Lessig 1971). Other aquatic invertebrates expected to exist in the well field include Turbellaria, Nematoda, Tardigrada, Hydrocarina, Amphipoda, Plecoptera, and a limited decapod fauna (Pennak 1966).

Threatened and Endangered Species. Federally protected species which could occur in the vicinity of the proposed South Well Field include the black-footed ferret, bald eagle, and peregrine falcon. The biology and habitat requirements of each of these species have been described in Section 2.A.1. During the May 1981 aerial

reconnaissance of the South Well Field, two prairie dog towns were located (Figure 2). Each of these towns was estimated to cover 2.5 acres and is located in the northwest corner of the proposed well field. Consequently, potential black-footed ferret habitat exists on the South Well Field. No known peregrine falcon or bald eagle nesting or roosting sites exist on or near the proposed South Well Field (Wyoming Game and Fish Department 1980a). No federally listed, proposed, or status review plant taxa are expected to occur within the boundaries of the South Well Field.

LaPrele Reservoir

Aquatic Biology. LaPrele Reservoir is an existing mainstem impoundment on LaPrele Creek. Faccianni (1981) has reported that in some years the reservoir is completely dry.

Fishes collected from LaPrele Creek and presumably also existing in LaPrele Reservoir are listed in Table 2-10. LaPrele Creek has been classified as Value Class III, which denotes a stream with a "substantial fishery resource" (U.S. Fish and Wildlife Service and Wyoming Game and Fish Commission 1978). The occasionally stocked trout populations are responsible for the Class III value.

Aquatic invertebrates expected to dominate the LaPrele Creek fauna include Diptera, Ephemeroptera, Coleoptera, Trichoptera, Odonata, and Mollusca. Other macroinvertebrates anticipated in the LaPrele drainage include Turbellaria, Nematoda, Tardigrada, Hydracarina, Amphipoda, Hemiptera, Plecoptera, and a depauperate decapod fauna (Pennak 1966).

Threatened and Endangered Species. Operation and/or maintenance of LaPrele Reservoir could affect populations of persistent sepal

yellow-cress (Rorippa calycina) if populations occur along LaPrele Creek. Presently Rorippa calycina is listed as a status review species by the U.S. Fish and Wildlife Service (Federal Register 45(242): 82480-82569). Although it is afforded no legal protection at the present time, it is under review for listing as either federally threatened or endangered.

Dorn (1980) lists sandy shores near the high-water mark as habitat for Rorippa calycina. The present known Wyoming distribution is limited to the North Platte River in Carbon County from Seminoe Reservoir to Medicine Bow (Dorn 1980). Since adequate habitat is available, Rorippa calycina could exist in the mouth of LaPrele Creek.

Combs Reservoir

Vegetation. The Soldier Creek basin is dominated by a prairie grassland vegetation type. The proposed reservoir lies within Kuchler's (1966) grama-needlegrass-wheatgrass grassland. On heavy clay soils of gentle slopes, the flora is dominated by grasses and low-growing forbs (Ecology Consultants, Inc. 1975b). Blue grama provides most of the perennial ground cover, which amounts to about 25 to 30 percent cover. Other common grasses in these areas are needle-and-thread and western wheatgrass, with prairie sandreed and threadleaf sedge occurring in localized patches. Plains pricklypear is also locally common (Ecology Consultants, Inc. 1975b), indicating heavy grazing pressure.

On coarse-textured soils on more upland sites and along gully banks, scattered patches of big sagebrush appear. The sagebrush occurs in low densities and provides less than 5 percent ground cover

(Ecology Consultants, Inc. 1975b). Aside from the sagebrush shrub layer, the species composition is similar to the more grassy areas.

Table 2-11 shows a breakdown of the affected area according to the vegetation types previously described in Section 2.A.1. In the prairie grassland type, there are numerous species of perennial and annual forbs, although none contributes substantially to overall ground cover. The prairie grassland vegetation type covers nearly 76 percent (622 acres) of the total area that would be affected by components of Combs Reservoir. The remainder of the area (198 acres) was classified as dry stream bottom by Ecology Consultants, Inc. (1975b). This vegetation type extends along the course of Soldier Creek and for a short distance up several tributaries. Soldier Creek, because of its intermittent flow, lacks sufficient water to support a riparian community, except for isolated cottonwoods and willows.

Streambank vegetation includes horsetail (*Equisetum* sp.), bulrush (*Scirpus* sp.), and slender wheatgrass (*Agropyron trachycaulum*). Alkali sacaton and black greasewood occur on more alkaline sites (Ecology Consultants, Inc. 1975b). On sandy streambanks two-grooved milkvetch (*Astragalus bisulcatus*), broom snakeweed (*Gutierrezia sarothrae*), spreading wildbuckwheat (*Eriogonum effusum*), fringed sagebrush (*Artemisia frigida*), Indian ricegrass (*Calamovilfa longifolia*), and snowball sand verbena (*Arbronia fragrans*) are common.

Terrestrial Wildlife.

Big Game. No site-specific big game census data exist for the area of the proposed reservoir; however, it seems likely that the area is used frequently by antelope and less frequently by mule deer. No known critical habitat for any big game species occurs near or within the proposed reservoir site (Wyoming Game and Fish Department 1980a).

TABLE 2-11

ACREAGES OF VEGETATION TYPES THAT WOULD BE AFFECTED BY CONSTRUCTION OF COMPONENTS OF COMBS RESERVOIR ON SOLDIER CREEK[a]

Reservoir Component	Vegetation Type	Acres
Reservoir proper[b]	Prairie Grassland	576
	Dry Stream Bottom	186
Dam	Prairie Grassland	37
	Dry Stream Bottom	12
Emergency Spillway (East)	Prairie Grassland	8
Emergency Spillway (West)	Prairie Grassland	
	Total	820

[a]Data from Ecology Consultants, Inc. (1975b).

[b]Acreages calculated at normal high-water line.

<u>Upland Game Birds</u>. Ecology Consultants, Inc. (1975b), during 1974 and 1975 studies of the proposed reservoir site, reported no upland game birds, although sage grouse are known to occur in the area (Oakleaf et al. 1979). Based on Wyoming Game and Fish Department (1980a) data and a survey of the area conducted in April 1981, there are no known sage grouse leks in the vicinity of the proposed reservoir.

<u>Raptors</u>. Raptors reported by Ecology Consultants, Inc. (1975b), in the Soldier Creek basin were the marsh hawk, red-tailed hawk, and golden eagle. No nests have been reported in the area. However, the Wyoming Game and Fish Department (1980a) reported a golden eagle roost in the northeast corner of R. 72 W., T 33 N., sec. 12, on the western limit of the proposed dam.

<u>Lagomorphs and Small Mammals</u>. Ecology Consultants, Inc. (1975b), has collected the thirteen-lined ground squirrel, olive-backed pocket mouse, Ord kangaroo rat (<u>Dipodmys ordii</u>), deer mouse, northern grasshopper mouse, western mouse and meadow vole from the Soldier Creek basin. We are unaware of any estimates of small mammal population densities for the proposed reservoir. However, since habitat at the proposed reservoir is somewhat similar to that of the plant site, we assume that small mammal densities are also comparable (approximately 10/acre).

Lagomorph densities at the proposed reservoir site were determined by night spotlighting during August 1974 (Ecology Consultants, Inc. 1975b) and are as follows:

- Cottontails - 313/sq mi
- White-tailed jackrabbits - 185/sq mi
- Black-tailed jackrabbits - 85/sq mi

The combined lagomorph density at the proposed reservoir site was 583/sq mi, or 0.9/acre.

Aquatic Biology. Combs Reservoir would be a mainstem impoundment of Soldier Creek formed by damming the creek at a location immediately upstream from its confluence with the North Platte River. Soldier Creek, an intermittent drainage, was considered a "Class 5" stream by the Wyoming Game and Fish Department (1977a) (see Table 2-7). Fishery data are not available for this stream, since the department generally does not survey intermittent streams. It is anticipated, however, that some fish species indigenous to the North Platte River would be found in the downstream areas of Soldier Creek during flowing water periods; the fish fauna of the North Platte River near its confluence with Soldier Creek are identified in Table 2-12.

Although aquatic macroinvertebrates have not been documented from the Soldier Creek drainage, collections were made in the area of the proposed intake on the North Platte River (Table 2-13). It is anticipated that a similar fauna, at least in terms of major groups, would exist in Soldier Creek during flowing water periods.

Threatened and Endangered Species. Three federally protected species could occur in the vicinity of the proposed Combs Reservoir: black-footed ferret, bald eagle, and peregrine falcon. No known bald eagle nests or winter roosts occur in the vicinity of the proposed reservoir (Wyoming Game and Fish Department 1980a). The peregrine falcon occurs in eastern Wyoming only as an occasional migrant. April 1981 surveys revealed that black-footed ferret habitat (prairie dog towns) does not exist in the immediate vicinity of the proposed reservoir; consequently, the black-footed ferret is not expected to occur in the area. The biology and habitat requirements of each of these species have been described in Section 2.A.1. No federally listed,

TABLE 2-12

FISHES COLLECTED IN THE NORTH PLATTE RIVER NEAR THE SOLDIER CREEK CONFLUENCE DURING APRIL AND MAY 1975

Common Name	Scientific Name
Trouts	Family Salmonidae
Rainbow trout	Salmo gairdneri
Minnows	Family Cyprinidae
Carp	Cyprinus carpio
Flathead chub	Hybopsis gracilis
Sand shiner	Notropis stramineus
Fathead minnow	Pimephales promelas
Suckers	Family Catostomidae
Longnose sucker	Catostomus catostomus
White sucker	Catostomus commersoni
Catfishes	Family Ictaluridae
Stonecat	Noturus flavus
Perches	Family Percidae
Walleye	Stizostedion vitreum vitreum

Source: Ecology Consultants, Inc. 1975b.

TABLE 2-13

AQUATIC INVERTEBRATES COLLECTED IN THE NORTH PLATTE RIVER NEAR THE PROPOSED INTAKE DURING APRIL AND MAY 1975

Common Name	Scientific Name
Aquatic Earthworms	OLIGOCHAETA
	Tubificidae
Roundworms	NEMATODA
Mollusks	MOLLUSCA
Snails	GASTROPODA
	Physa sp.
	Ferrissia sp.
Insects	INSECTA
Mayflies	EPHEMEROPTERA
	Ephemerellidae
	Ephemerella aurivilli
	Baetidae
	Baetis sp.
	Tricorythidae
	Tricorythides sp.
Stoneflies	PLECOPTERA
	Perlidae
	Isoperla sp.
Caddisflies	TRICHOPTERA
	Hydropsychidae
	Hydropsyche sp.
	Cheumatopsyche sp.
	Hydroptilidae
	Agraylea sp.
	Glossosomatidae
	Glossosoma sp.
True flies	DIPTERA
Midges	Chironomidae
	Cardiocladius sp.
	Orthocladius sp.
	Polypedilum falax
	Endochironomous sp.
	Chironomous sp.
	Thienemannemyia sp.
	Cricotopus sp.
	Unidentified sp.
	Unidentified pupae
Black flies	Simulidae
	Unidentified sp.

Source: Ecology Consultants, Inc. 1975b.

proposed, or status review plant taxa are known to occur in the Soldier Creek basin.

North Platte Intake

Vegetation. The North Platte River intake would be situated in riparian vegetation on the north side of the North Platte River, just south of the proposed Combs Reservoir (Figure 1). The area is covered by scattered groves of plains cottonwood and peachleaf willow (Salix amygdaloides). Perennial ground cover in the riparian zone is variable, averaging about 40 percent, and a definable shrub layer is lacking except for scattered young cottonwoods and willows. Ecology Consultants, Inc. (1975b), divided the riparian woodlands along the North Platte River into two subtypes. The first subtype, which lines the river's margin, is a rush (Juncus torreyi)/bulrush (Scirpus acutus) community that typically occupies wet areas next to the water. The rush/bulrush community provides about 80 percent ground cover and occupies a strip along the river margin ranging from 8 to 15 feet in width.

The second subtype consists of a dry streambank community consisting largely of perennial grasses and large cottonwoods (Ecology Consultants, Inc. 1975b). Grasses are dominated by alkali sacaton, western wheatgrass, and sand dropseed (Sporobolus cryptandrus). Alkali cordgrass (Spartina gracilis), bulrush (Scirpus americanus), and cottonwood seedlings typically occur along the bottom of flood channels. Common weedy forbs, including oakleaf goosefoot (Chenopodium glaucum) and brushy knotweed (Polygonum ramosissimum), occur in localized areas next to the river (Ecology Consultants, Inc. 1975b).

Terrestrial Wildlife. The proposed North Platte River reentry channel would affect approximately 3 acres of sparse riparian vegetation.

Big Game. Big game species use riparian areas to avoid thermal stress; the cooler, more humid regime allows relief from hot, dry days. This habitat also provides escape cover and winter range for some big game species.

White-tailed and mule deer are probably the most abundant big game species at the proposed intake site. Delivery lines would traverse year-round mule deer and antelope habitat. No critical big game habitat would be affected (Wyoming Game and Fish Department 1980a).

Upland Game Birds. The most dramatic use of riparian habitat is by birds: wooded riparian habitat supports more birds per acre than any other forest type (Carothers 1977; Waner 1977; Johnson et al. 1977). Most upland game birds, however, with the exception of ring-necked pheasant and possibly turkey, would avoid riparian areas.

Waterfowl. Construction near the North Platte River could affect waterfowl and other water-associated birds. Waterfowl known to occur in the vicinity of the proposed intake are listed in Appendix A, Table A-2.

Raptors. Large cottonwood trees in the vicinity of the proposed North Platte intake provide roost sites for a variety of raptors. April and May 1981 aerial surveys from the Wyoming Game and Fish Department (1980a) revealed that no known raptor nests occur in the immediate vicinity.

Aquatic Biology. The proposed North Platte River intake would consist of a short diversion channel oriented away from the mainstream,

with an intake and pumphouse at the end of the channel. The intake would be located directly downstream of the confluence of Soldier Creek with the North Platte River, and would pump water to Combs Reservoir.

The North Platte River in the vicinity of the proposed intake has been classified as Value Class III by the U.S. Fish and Wildlife Service and Wyoming Game and Fish Commission (1978), which indicates the existence of a substantial fishery resource. Physicochemical and aquatic biological characteristics of the river at the proposed diversion site were studied during the spring of 1975 (Ecology Consultants, Inc. 1975b).

The taxonomic composition of periphyton and phytoplankton samples collected by Ecology Consultants, Inc., during the 1975 study is reported in Table 2-14. Benthic macroinvertebrate taxa collected during the same period are presented in Table 2-13. Ecology Consultants, Inc. (1975b), reported that benthic densities of only a few organisms per square foot were common in the sampling area before several upstream reservoirs (e.g., Pathfinder Reservoir) were constructed. Presumably, flood waters regularly scoured indigenous invertebrates out of the substrate. During the 1975 sampling period, however, benthic densities were reported to be approximately 1400-4200 organisms per square foot and $\bar{H}$ diversity values were reported as approximately 2.5 and 2.1 during April and May, respectively. While these figures would generally indicate a reasonably unpolluted river area, the authors felt that the elevated sil~~t lo~~ad adversely affected the river benthic populations.

Fishes reported in the intake area have been presented in Table 2-12. Two game fishes, rainbow trout and walleye, are included in the list. The Wyoming Game and Fish Department (1979) reported brown

TABLE 2-14

PERIPHYTON AND PHYTOPLANKTON SPECIES REPORTED IN THE NORTH PLATTE RIVER NEAR THE PROPOSED INTAKE DURING APRIL AND MAY 1975

Common Name	Scientific Name
Blue-green algae	Phylum Cyanophyta
	Lyngbya largerheimii
	Lyngbya sp.
	Oscillatoria sp.
Green algae	Phylum Chlorophyta
	Cladophora glomerata
	Scenedesmus sp.
	Scenedesmus acuminatus
	Spirogyra sp.
Yellow-brown algae	Phylum Chrysophyta
Diatoms	Class Bacillariophyceae
	Acanthes lanceolata
	Acanthes sp.
	Amphipora alata
	Amphora ovalis
	Caloneis amphisbaena
	Caloneis ventricossa
	Cocioneis disculus
	Cocioneis pediculus
	Cocioneis placentula
	Cymatopleura solea
	Cymbella affinis
	Cymbella naviculiformis
	Cymbella prostrata
	Cymbella ventricosa
	Cymbella sp.
	Diatoma anceps
	Diatoma tenue var.pelongatum
	Diatoma vulgare
	Diatoma vulgare var.pbreve
	Epithemia sorex
	Epithemia turbida
	Fragilaria construens
	Fragilaria virescens
	Fragilaria sp.
	Gomphonema olivaceum
	Gomphonema parvulum
	Gomphonema sp.

TABLE 2-14 Concluded

PERIPHYTON AND PHYTOPLANKTON SPECIES REPORTED IN THE NORTH PLATTE RIVER NEAR THE PROPOSED INTAKE DURING APRIL AND MAY 1975

Common Name	Scientific Name
	Gyrosigma spencerii
	Hantzschia amphioxys
	Melosira varians
Yellow-brown algae	Phylum Chrysophyta
Diatoms (Continued)	Class Bacillariophyceae
	Navicula angusta
	Navicula cryptocephala
	Navicula cuspidata
	Navicula elginensis
	Navicula lanceolata
	Navicula pupula
	Navicula tripunctata
	Navicula sp.
	Nitzschia acicularis
	Nitzschia dissipata
	Nitzschia holsatica
	Nitzschia linearis
	Nitzschia palea
	Nitzschia sigmoidea
	Nitzschia vermicularis
	Nitzschia sp.
	Pleurosigma delicatulum
	Rhoicosphenia curvata
	Rhopalodia gibba
	Rhopalodia ventricosa
	Stephanodiscus hantzschii
	Stephanodiscus niagarae
	Surirella ovata
	Surirella sp.
	Synedra acus
	Synedra rumpens
	Synedra ulna

Source: Ecology Consultants, Inc. 1975b.

trout, yellow perch, channel catfish, black bullhead, river carpsucker, and northern redhorse, in addition to those reported in Table 2-12. Fishing intensity is approximately 136 fishermen days per year per mile. This portion of the North Platte is managed under the basic yield concept. It is not managed for trophy fish, unique species, or wild fish, although they may be present.

Threatened and Endangered Species. The potential exists for the occurrence of Rorippa calycina, discussed earlier, at the proposed intake site. Wintering bald eagles occur in the vicinity of the proposed intake (the biological and habitat requirements of the bald eagle have been discussed in Section 2.A.1). Aerial surveys have indicated that adequate habitat for the black-footed ferret (prairie dog towns) is lacking at the proposed intake site.

The potential exists for possible impacts to the whooping crane (Grus americana) from operation of the North Platte intake. The whooping crane is listed as endangered by the U.S. Fish and Wildlife Service (32 FR 4001, March 11, 1967; 35 FR 8495, June 2, 1970). In May 1978 (43 FR 20938, May 15, 1978), the U.S. Fish and Wildlife Service designated the area of the Platte River from Lexington to Denman, Nebraska (about 53 river miles in the Big Bend area), as critical habitat for the whooping crane. The critical habitat is approximately 320 miles east of the proposed intake.

The Big Bend area is an extremely important natural resource, especially with respect to wildlife (Aronson and Ellis 1979). Along with the whooping crane, many other wildlife species, including bald eagles, ducks, geese, and sandhill cranes, utilize the central Platte River valley.

Whooping cranes use the Big Bend area in the spring months (late February to early May) as a staging area and in the fall months as a stopover point during their normal migratory flights from breeding grounds in northwestern Canada to wintering areas on the Texas Gulf Coast (Aronson and Ellis 1979). Wet meadows adjacent to the river are important feeding areas for the cranes (Frith 1974). According to Keech (1964), these wet meadows are linked to the Platte River hydrological system. Consequently, changes in river level are reflected in the ground-water levels in these wet meadows. Aronson and Ellis (1979) concluded that "there is no doubt that there has been a degradation of usable crane habitat in some locations, and the evidence strongly suggests that the decline in flow has reduced the natural scouring which once kept vegetative encroachment from becoming well established within the main channel."

Annual scouring of the main channel is an important factor for maintenance of crane habitat. In areas where the river is wide, flows have not kept vegetation scoured (Aronson and Ellis 1979); whereas in narrower channels, even recently reduced flows have kept islands and sand bars free of encroachment.

Water Pipelines

Two water pipelines are proposed for the delivery of water to the plant site from the North and South well fields and Combs Reservoir. Because of its relatively short length outside the well field boundary, the pipeline from the North Well Field to the plant site has been included under the description of the North Well Field, above. With the exception of stream crossings outside the North Well Field boundary, the following discussion refers only to the corridor from the South Well Field to the Combs Reservoir pump station and from there to the plant site.

Vegetation. Assuming a 50-foot corridor, the proposed pipeline from the South Well Field to the plant site would temporarily disturb 130.2 acres of prairie grassland, 25.9 acres of agricultural lands and 2.4 acres of riparian vegetation outside the well field boundary (Figure 1). Table 2-15 is a breakdown of vegetation types encountered along this pipeline; mileposts are measured from the South Well Field collection point.

Terrestrial Wildlife. Wildlife species that could occur in the vicinity of the proposed pipeline from the South Well Field to the plant site are listed in Appendix A (Table A-2).

Big Game. The proposed corridor would traverse year-round mule deer and antelope habitat. No critical big game habitat occurs in the vicinity (Wyoming Game and Fish Department 1980a).

Upland Game Birds. Surveys conducted in April 1981 and data from the Wyoming Game and Fish Department (1980a) revealed no sage grouse strutting grounds in the vicinity of the proposed corridor. The distribution of other upland game birds in Converse County has been described in Section 2.A.1.

Waterfowl. Several small gully-plug reservoirs would be traversed by the proposed corridor. Each of these reservoirs provides some waterfowl habitat (McKnight 1981), although their regional value is negligible. In addition, waterfowl habitat exists at the proposed North Platte River crossing. Waterfowl species that occur in the ~~area~~ containing the proposed corridor are listed in Appendix A, Table A-2.

Raptors. According to aerial surveys conducted in April and May 1981, no known eagle or buteo nests or roosts occur in the vicinity of the proposed corridor. However, several red-tailed hawk nests

TABLE 2-15

VEGETATION TYPES THAT WOULD BE TRAVERSED BY THE SOUTH WELL FIELD TO PLANT SITE WATER SUPPLY PIPELINE

Mile Length	Acreage	Habitat Type
0.0 - 0.7	4.2	Prairie grassland
0.7 - 1.3	3.6	Agriculture
1.3 - 2.7	8.5	Prairie grassland
2.7 - 2.9	1.2	Agriculture
2.9 - 3.1	1.2	Prairie grassland
3.1 - 3.4	1.8	Agriculture
3.4 - 5.7	13.9	Prairie grassland
5.7 - 6.4	4.2	Agriculture
6.4 - 9.6	19.4	Prairie grassland
9.6 - 9.8	1.2	Agriculture
9.8 - 10.0	1.2	Riparian
10.0 - 11.3	7.9	Prairie grassland
11.3 - 13.6	13.9	Agriculture
13.6 - 13.7	0.6	Riparian
13.7 - 13.8	----	North Platte River
13.8 - 13.9	0.6	Riparian
13.9 - 26.3	75.1	Prairie grassland
Total 26.3 miles	158.5 acres	

occur at the proposed North Platte River crossing (Wyoming and Game and Fish Department 1980a).

Aquatic Biology. Streams that would be traversed by the proposed water pipelines are presented in Tables 2-16 and 2-17. Streams that would be crossed by the proposed corridor from the North Well Field to the plant lie within the Cheyenne River drainage, while streams that would be crossed by the pipeline from the South Well Field to the plant lie within the North Platte River drainage. Physical stream characteristics and fish and macroinvertebrate faunas for these areas have been discussed throughout Section 2.A.2.

Threatened and Endangered Species. Federally protected species that could occur in the vicinity of the proposed pipeline corridors include the black-footed ferret, bald eagle, and peregrine falcon; the biological and habitat requirements of these species have been described in Section 2.A.1. The absence of prairie dog towns along the corridors precludes the possible occurrence of the black-footed ferret. No known peregrine falcon or bald eagle nesting or roosting sites exist on or near the proposed corridors (Wyoming Game and Fish Department 1980a).

2.A.3 RAILROAD

Vegetation

Vegetation types that would be traversed by the proposed railroad corridor are listed in Table 2-18, by milepost. The proposed corridor would traverse approximately 0.9 mile of plains cottonwood habitat, 1.9 miles of agricultural lands, and 40.1 miles of prairie grassland (Figure 1). Assuming a 200-foot railroad corridor (24.24 acres/mile), these mileages convert to the following approximate acreages: 22 acres of plains cottonwood habitat, 46 acres of agriculture, and 972 acres of prairie grassland.

TABLE 2-16

FLOW CHARACTERISTICS OF STREAMS AND RIVERS THAT WOULD BE CROSSED BY THE PROPOSED SOUTH WELL FIELD TO PLANT SITE PIPELINE

Stream	MP	Flow
UT Box Elder Creek	0.2	I
UT Box Elder Creek	0.6	I
Unnamed stream	1.7	I
Unnamed stream	1.9	I
West Side Ditch	3.2	P
Unnamed stream	3.8	P
Unnamed stream	4.5	P
Unnamed stream	5.2	P
Unnamed stream	5.8	P
Unnamed stream	8.8	I
Unnamed ditch	9.8	P
LaPrele Creek[1]	10.5	P
Morton Ditch	11.3	P
North Platte River[1]	14.4	P
Unnamed stream	14.6	I
Unnamed stream	15.6	I
Unnamed stream	15.9	I
Unnamed stream	16.3	I
Unnamed stream	17.0	I
Unnamed stream	17.2	I
Unnamed stream	19.5	I
Unnamed stream	21.9	I
Unnamed stream	23.4	I
Unnamed stream	23.6	I
Unnamed stream	26.2	I

MP = Approximate milepost at proposed crossing
I = Intermittent
P = Perennial
UT = Unnamed Tributary
1 = Individual Section 404 Permit required

TABLE 2-17

FLOW CHARACTERISTICS OF STREAMS THAT WOULD BE CROSSED BY THE PROPOSED NORTH WELL FIELD TO PLANT SITE PIPELINE

Stream	MP	Flow
Unnamed stream	0.5	I
Little Lightning Creek	2.3	I
UT Little Lightning Creek	2.8	I
UT Little Lightning Creek	3.4	I
UT Little Lightning Creek	3.6	I
UT Little Lightning Creek	4.0	I
UT Little Lightning Creek	4.8	I

MP = Approximate milepost at proposed crossing
I = Intermittent
UT = Unnamed tributary

TABLE 2-18

VEGETATION HABITAT TYPES THAT WOULD BE TRAVERSED BY THE PROPOSED RAILROAD[a]

Rail Line Milepost Location[b]	Vegetation Habitat Type
0.0 - 2.0	Prairie grassland
2.0 - 2.4	Agriculture
2.4 - 12.0	Prairie grassland
12.0 - 12.2	Agriculture
12.2 - 18.2	Prairie grassland
18.2 - 19.1	Agriculture
19.1 - 28.3	Prairie grassland
28.3 - 28.7	Agriculture
28.7 - 38.0	Prairie grassland
38.0 - 38.9[c]	Riparian
38.9 - 42.9	Prairie grassland

[a]Distances through vegetation habitat types were estimated from 1:80,000-scale aerial photography.

[b]Lists the railroad mileposts through that vegetation habitat type.

[c]Located at the proposed Antelope Creek crossing.

Agricultural land in the area is used primarily for dryland farming of wheat or cultivated pasture species (Ecology Consultants, Inc. 1975c). Abandoned croplands are generally predominated by weedy species such as red threeawn (Aristida longiseta) and yellow salsify (Tragopogon dubius). On the older abandoned fields, needle-and-thread, blue grama, western wheatgrass, and big sagebrush have invaded to the point of resembling the original communities (Ecology Consultants, Inc. 1975).

Most of the proposed railroad route would traverse prairie grassland consisting of a mixture of sagebrush and grasses. Big sagebrush is the dominant shrub species and occurs in varying densities, providing between 0 to 25 percent ground cover (Ecology Consultants, Inc. 1975c). The 0.5- to 1-meter-high sagebrush appears to increase in density on deeper soils.

Nuttall sagebrush frequently replaces big sagebrush on more alkaline upland sites. Western wheatgrass and blue grama dominate the understory, and other important, but less frequently encountered, species include needle-and-thread, threadleaf sedge, cheatgrass (Bromus tectorum), and plains pricklypear. In the breaks area the sagebrush is sparse and a greater proportion of shrubs other than big sagebrush occurs (Ecology Consultants, Inc. 1975c). The diversity of forbs is also higher in the breaks area.

In the upland, more grassy areas, the flora is composed of a mixture of grasses and low forbs dominated by wheatgrasses (Agropyron spp.) and needlegrasses (Stipa spp.). Prairie junegrass and blue grama are also important. On more sandy sites, Indian ricegrass (Oryzopsis hymenoides) and prairie sandreed (Calamovilfa longifolia) predominate (Ecology Consultants, Inc. 1975c). Plains pricklypear is common in areas with heavy grazing pressure and vegetative cover ranges from 15 to 40 percent in these more grassy areas.

Along the stream bottoms and gullies, species with higher water requirements predominate. Plains cottonwood (Populus sargentii) and mixed stands of black greasewood (Sarcobatus vermiculatus), big sagebrush, and silver sagebrush (Artemisia cana) form scattered groves (Ecology Consultants, Inc. 1975c). Sweet clover (Melilotus officinalis) and locoweed (Astragalus sp.) also grow along the streambanks. The most common grass species in wet meadows and along the stream bottoms are alkali sacaton (Sporobolus airoides), Canada wildrye (Elymus canadensis), and foxtail (Hordeum jubatum). Scattered streambank patches of rushes (Scirpus acutus and Juncus sp.) and willow (Salix sp.) are present on major drainages such as Box Creek and the Dry Fork Cheyenne River. Dry lake beds and playas support alkali sacaton, foxtail, western wheatgrass, inland saltgrass (Distichlis stricta), greasewood, and Nuttall saltbush (Ecology Consultants, Inc. 1975c).

The Missouri River Basin Commission (1959) estimated range grazing capacity for several isolated tracts near the proposed railroad corridor (Table 2-19). Total AUMs/acre ranged between 0.05 and 0.25 near the proposed corridor. According to Loeper (1981), this area presently supports 0.2 AUM/acre; thus 203 total AUMs would be affected by the 200-foot railroad corridor.

Terrestrial Wildlife

Wildlife species that could occur in the vicinity of the proposed electric railroad are listed in Appendix A (Tables A-1, A-2, A-3). These lists were constructed from distribution data provided by Long (1965), Oakleaf et al. (1979), and Baxter and Stone (1980).

Big Game. The proposed railroad route would traverse year-round and/or winter habitat for mule deer and antelope. In addition, white-tailed deer occur in the Antelope Creek basin (Econ, Inc. 1980a). No

TABLE 2-19

ANIMAL UNIT MONTH ESTIMATES FOR SELECTED PLOTS ADJACENT TO THE PROPOSED RAILROAD CORRIDOR

Township, Range, and Section	Acres	Total AUMs for Plot	Estimated AUM/Acre
T. 37 N., R. 69 W., Sec. 2	40	10	0.25
T. 37 N., R. 69 W., Sec. 10	120	30	0.25
T. 37 N., R. 69 W., Sec. 24	320	16	0.05
T. 37 N., R. 69 W., Sec. 25	560	28	0.05
T. 37 N., R. 69 W., Sec. 33	40	2	0.05
T. 37 N., R. 69 W., Sec. 34	160	8	0.05
T. 37 N., R. 69 W., Sec. 35	480	24	0.05
T. 35 N., R. 70 W., Sec. 21	240	48	0.20

AUM estimates are from Land Classification Reports made by the Missouri River Basin field crew for the North Platte Area, Bureau of Land Management, 1956-1959.

critical habitat for big game species has been identified in the vicinity of the proposed corridor (Wyoming Game and Fish Department 1980a). However, Gassen (1981) reported that the area immediately surrounding Porcupine Creek is important winter habitat for mule deer (Figure 2). The winter range of mule deer is often restricted by the availability of ample forage; during winter months, deer tend to concentrate in areas that provide forage. More detailed information on the biological and habitat requirements of big game species has been presented in Section 2.A.1.

Upland Game Birds. Oakleaf et al. (1979) reported the following upland game birds in the area that would be traversed by the proposed railroad corridor: blue grouse, sage grouse, ring-necked pheasant, chukar, gray partridge, and turkey. The biology and distribution of these species in Converse County are described in Section 2.A.1. The only species of concern that occurs in the vicinity of the proposed railroad is the sage grouse. Komberak (1980) mapped a single sage grouse lek in the vicinity of the proposed right-of-way (Figure 2). This lek is probably less than 0.2 mile east of the proposed corridor at MP 29.

Raptors. Several raptor nests and winter roosts have been identified in the vicinity of the proposed railroad corridor. The proximity of these nests and roosts to the right-of-way is listed in Table 2-20. The precise locations of these sites are mapped on Figure 2.

Aquatic Biology

The proposed railroad would cross the Cheyenne River basin streams identified in Table 2-21. These streams are all spatially or temporally intermittent at the proposed crossing locations. The Wyoming Game and Fish Department (1977a) considers these stream sections to be Class 5 waterways, which are generally incapable of sustaining a fishery.

TABLE 2-20

DISTANCES OF EAGLE AND BUTEO NESTS AND WINTER ROOSTS FROM THE PROPOSED RAILROAD CORRIDOR THROUGH CAMPBELL AND CONVERSE COUNTIES, WYOMING

Type	Location
Golden Eagle Nest	T. 41 N., R. 70 W., Sec. 9 and 16 (0.5 mile NW of turnaround loop)
Golden Eagle Nest	T. 41 N., R. 70 W., Sec. 15 (0.4 mile E of turnaround loop)
Golden Eagle Nest	T. 41 N., R. 70 W., Sec. 16 (0.15 mile W of MP 41)
Golden/Bald Eagle Winter Roost	T. 41 N., R. 70 W., Sec. 25 (1.2 miles NE MP 39)
Golden Eagle Nest	T. 40 N., R. 70 W., Sec. 1 (0.6 mile SW MP 37)
Inactive Golden Eagle Nest	T. 40 N., R. 70 W., Sec. 11 (1.7 miles SW MP 37)
Golden Eagle Nest	T. 40 N., R. 69 W., Sec. 5 (1.4 miles NE MP 35.5)
Golden Eagle Nest	T. 39 N., R. 69 W., Sec. 4 (2.0 miles SE MP 35.5)
Inactive Golden Eagle Nest	T. 39 N., R. 70 W., Sec. 27 (0.7 mile E MP 24.5)
Ferruginous Hawk Nest	T. 39 N., R. 70 W., Sec. 27 (0.5 mile E MP 24.5)
Ferruginous Hawk Nest	T. 38 N., R. 70 W., Sec. 35 (1.0 mile E MP 12)

Data from Wyoming Game and Fish Department (1980a) and Komberak (1980).

TABLE 2-21

LOCATIONS AND FLOW CHARACTERISTICS OF STREAMS TRAVERSED BY THE PROPOSED RAILROAD

Stream	MP	Flow	County
UT Lightning Creek	0.5	I	Converse
UT Lightning Creek	0.7	I	Converse
UT Little Lightning Creek	2.2	I	Converse
Lightning Creek	5.3	I	Converse
Unnamed Stream	7.8	I	Converse
Unnamed Stream	9.0	I	Converse
Unnamed Stream	9.4	I	Converse
Unnamed Stream	9.8	I	Converse
Mike's Draw Creek	11.4	I	Converse
Unnamed Stream	14.4	I	Converse
Unnamed Stream	14.5	I	Converse
UT Reeve's Draw Creek	15.5	I	Converse
Reeve's Draw Creek	15.6	I	Converse
Dry Creek	16.9	I	Converse
Sheldon Draw Creek	18.0	I	Converse
Unnamed Stream	22.9	I	Converse
Unnamed Stream	24.0	I	Converse
Colony Draw Creek	24.4	I	Converse
Willow Draw Creek	26.0	I	Converse
Dry Fork Cheyenne River	27.0	I	Converse
UT Ford Draw Creek	27.8	I	Converse
Ford Draw Creek	27.9	I	Converse
UT Dry Fork Cheyenne	28.5	I	Converse
Bad Creek	29.0	I	Converse
Woody Creek	29.6	I	Converse
Unnamed Stream	30.7	I	Converse
Unnamed Stream	31.7	I	Converse
Unnamed Stream	32.4	I	Converse
Coal Draw Stream	33.3	I	Converse
Unnamed Stream	33.7	I	Converse
Unnamed Stream	34.2	I	Converse
Unnamed Stream	34.5	I	Converse
Unnamed Stream	35.3	I	Converse
UT Antelope Creek	37.0	I	Converse
UT Antelope Creek	37.5	I	Converse
Antelope Creek	38.0	I	Converse
UT Antelope Creek	38.3	I	Converse
Porcupine Reservoir	39.2	I	Converse
Porcupine Creek	a	I	Campbell

UT = Unnamed tributary.
MP = Railroad milepost.
I = Intermittent.

[a]Turnaround loop.

Wesche and Johnson (1980) conducted aquatic surveys in the Thunder Basin National Grassland and presented baseline data for the Antelope, School, and Little Thunder creek drainages. Fishes collected during their studies are presented in Table 2-22. It is anticipated that other drainages to be crossed by the proposed railroad would sustain similar fish faunas, at least during occasional flowing water periods.

Benthic macroinvertebrates were also collected by Wesche and Johnson (1980), and a list of indigenous taxa is presented in Table 2-23. It is anticipated that this list is representative of the general faunal composition of benthic communities in most of the drainages potentially affected by the railroad. A detailed description of water quality characteristics and benthic community diversity of area streams is presented in Section 2.B.1.

Threatened and Endangered Species

Three federally classified endangered species could occur in the general vicinity of the railroad corridor: black-footed ferret, peregrine falcon, and bald eagle. The peregrine falcon occurs in this portion of Wyoming only as an occasional migrant. Any active prairie dog town provides potential habitat for the black-footed ferret. Although no bald eagle nests are known in the vicinity of the proposed railroad corridor, the route would pass 1.2 miles to the west of a bald eagle winter roost (Figure 2). Individual eagles could be encountered along the entire railroad route, especially at the proposed Antelope Creek crossing. The proposed railroad corridor would traverse or run adjacent to (within 2 miles of) 11 prairie dog towns. These towns are listed in Table 2-24 and mapped on Figure 2. No federally listed, proposed, or status review plant taxa occur in the vicinity of the proposed railroad corridor.

TABLE 2-22

FISHES COLLECTED FROM ANTELOPE, SCHOOL, AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
Minnows	Family Cyprinidae
Carp	Cyprinus carpio
Flathead chub	Hybopsis gracilis
Longnose dace	Rhinichthys cataractae
Sand shiner	Notropis stramineus missouriensis
Fathead minnow	Pimephales promelas
Plains minnow	Hybognathus placitus
Suckers	Family Catostomidae
White sucker	Catostomus commersoni
Catfishes	Family Ictaluridae
Black bullhead	Ictalurus melas
Sunfishes	Family Centrarchidae
Green sunfish	Lepomis cyanellus
Killifishes	Family Cyprinodontidae
Plains killifish[a]	Fundulus zebrinus

Source: Wesche and Johnson (1980).

[a]Recently, the accepted scientific name of the plains killifish was changed from F. kansae to F. zebrinus.

TABLE 2-23

TAXONOMIC CLASSIFICATION OF THE BENTHIC FAUNA OF ANTELOPE, SCHOOL, AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
Freshwater Shrimp	Amphipoda
	Talitridae
	Hyallela azteca
Water Mites	Hydracarina
	Limnocharidae
	Limnochares sp.
Segmented Worms	Annelida
Aquatic earthworms	Oligochaeta
	Tubificidae
Leeches	Hirudinea
	Glossiphoniidae
Mollusks	Mollusca
Snails	Gastropoda
	Physidae
	Physa sp.
	Lymnaeidae
	Lymnaeae sp.
	Ancylidae
	Ferrissia sp.
	Planorbidae
	Gyraulus sp.
Clams	Pelecypoda
	Sphaeriidae
	Sphaerium sp.
Insects	Insecta
Mayflies	Ephemeroptera
	Caenidae
	Caenis sp.
Damselflies, Dragonflies	Odonata
- Damselflies	Zygoptera
	Coenagrionidae
	Ischnura sp.
	Argia sp.

TABLE 2-23 Concluded

TAXONOMIC CLASSIFICATION OF THE BENTHIC FAUNA OF ANTELOPE, SCHOOL, AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
- Dragonflies	Anisoptera
	Libellulidae
	Somatochlora sp.
	Aeshnidae
	Aeshna sp.
Caddisflies	Trichoptera
	Phryganeidae
	Phryganea sp.
	Limnephilidae
	Limnephilus sp.
	Psychomyiidae
	Polycentropus sp.
Beetles	Coleoptera
Riffle beetles	Elmidae
	Dubiraphia sp.
Crawling water beetles	Haliplidae
	Haliplus sp.
Water scavenger beetles	Hydrophilidae
	Berosus sp.
Predaceous diving beetles	Dytiscidae
	Hydaticus sp.
Flies	Diptera
Midges	Chironomidae
	Chironomus sp.
	Pentaneura sp.
Biting midges	Ceratopogonidae
	Palpomyia sp.
	Dasyhela sp.
Horseflies	Tabanidae
	Chrysops sp.
	Tabanus sp.
Mosquitoes, phantom midges	Culicidae
	Chaoborus sp.
Long-legged flies	Dolichopodidae
Soldier flies	Stratiomyidae

Source: Wesche and Johnson (1980).

TABLE 2-24

LOCATIONS OF PRAIRIE DOG TOWNS WITHIN 2 MILES OF PROPOSED PROJECT COMPONENTS

Component	Size (acres)	Location
PRODUCT PIPELINE		
Traversed at MP 67	229	T. 26 N., R. 65 W., Sec. 28,29,32,33
Traversed at MP 148	26	T. 13 N., R. 65 W., Sec. 5
SOUTH WELL FIELD		
Northwest corner of well field	2.5	T. 33 N., R. 74 W., Sec. 35
Northwest corner of well field	2.5	T. 32 N., R. 74 W., Sec. 1
RAILROAD		
0.1 mile north of turnaround loop	28	T. 41 N., R. 70 W., Sec. 9,16
1.4 mile west of turnaround loop	59	T. 41 N., R. 70 W., Sec. 17
Traversed at MP 40.5	18	T. 41 N., R. 70 W., Sec. 21,22,27,28
0.5 mile east of MP 40.5	7	T. 41 N., R. 70 W., Sec. 22
0.5 mile east of MP 39	12	T. 41 N., R. 70 W., Sec. 34
0.2 mile east of MP 38	186	T. 41 N., R. 70 W., Sec. 26,35,36
Traversed at MP 37	437	T. 40 N., R. 70 W., Sec. 1,2
		T. 41 N., R. 70 W., Sec. 35,36
0.25 mile east of MP 30	163	T. 39 N., R. 70 W., Sec. 6,7
0.35 mile east of MP 28.8	36	T. 39 N., R. 71 W., Sec. 12
Traversed at MP 27	738	T. 39 N., R. 71 W., Sec. 11,13,14,15
0.75 mile west of MP 27	334	T. 39 N., R. 71 W., Sec. 16,17,20,21
MINE		
Center of Mine	32	T. 41 N., R. 70 W., Sec. 1
		T. 41 N., R. 69 W., Sec. 6
1.5 mile east of east mine boundary	31	T. 41 N., R. 69 W., Sec. 4
1.3 mile southeast of southeast mine boundary	73	T. 41 N., R. 69 W., Sec. 21

2.A.4 TRANSMISSION LINES

Vegetation

All proposed transmission lines in the South Well Field would be constructed in the proposed gathering line corridors. Consequently, additional vegetation would not be disturbed. Six segments in the North Well Field would require individual 50-foot-wide construction corridors; the vegetation that would be disturbed is prairie grassland type (59.1 acres). Approximately 4.2 acres of agricultural lands and 13.9 acres of prairie grassland would be affected by construction of the transmission line to be used for plant site construction. Affected acreages are summarized in Table 2-25.

Terrestrial Wildlife

Wildlife species in this area have been discussed in Section 2.A.1. No critical big game habitat would be traversed (Wyoming Game and Fish Department 1980a). April 1981 aerial surveys revealed no sage grouse leks in the vicinity of the proposed rights-of-way. No known raptor nests occur in the vicinity of the proposed transmission lines (Wyoming Game and Fish Department 1980a).

Aquatic Biology

Streams in the well fields are within the Cheyenne and North Platte drainages. These streams and associated aquatic fauna have been discussed in detail in Section 2.A.2. There is little or no aquatic habitat on the proposed coal gasification plant site (see Section 2.A.1).

Threatened and Endangered Species

The absence of prairie dog towns near the proposed transmission line corridors precludes the possible occurrence of the black-footed ferret. Bald eagles could occur throughout the proposed construction

TABLE 2-25

ACREAGES OF VEGETATION THAT WOULD BE DISTURBED BY CONSTRUCTION OF TRANSMISSION LINES ON THE COAL GASIFICATION PLANT AND NORTH WELL FIELD[a,b]

Transmission Line	Distance (miles)	Acres	Vegetation Habitat Type
<u>Coal Gasification Plant</u>			
Plant to existing line in T. 35 N., R. 30 W., sec. 16	3.0	18.1	Prairie grassland (13.9) Agricultural land (4.2)
<u>North Well Field</u>			
Substation to T. 34 N., R. 71 W., sec. 2	1.4	8.6	Prairie grassland
Pump station to Morton No. 20	4.4	26.7	Prairie grassland
Morton No. 8 to Morton No. 9	.9	5.5	Prairie grassland
Morton No. 2 to T. 34 N., R. 71 W., sec. 2	1.0	6.1	Prairie grassland
Morton No. 3 to T. 34 N., R. 71 W., sec. 11	1.0	6.1	Prairie grassland
Morton No. 7 to Morton No. 6	1.0	6.1	Prairie grassland
TOTAL	12.7	77.2	

[a]Only those lines which would not be located in proposed gathering line corridors are included.

[b]Assumes a 50-foot wide construction corridor.

area, although nests and winter roosts are absent. No federally listed or proposed threatened or endangered plant taxa occur in the vicinity.

2.A.5 ROADS

Vegetation

The proposed 4.3-mile access road to the proposed Combs Reservoir would permanently disturb 52.1 acres of prairie grassland. Additional acreages would be affected by construction of proposed access roads in well fields; these are summarized in Tables 2-26 and 2-27.

Terrestrial Wildlife

The wildlife in the general area of the proposed roads has been described in Section 2.A.2. Big game critical habitat is lacking in the area (Wyoming Game and Fish Department 1980). No known raptor nests or sage grouse leks are situated near proposed rights-of-way.

Aquatic Biology

The aquatic habitat that would be traversed by proposed roads lies within the Cheyenne and North Platte drainages. The biological characteristics of these drainages have been discussed in Sections 2.A.1 and 2.A.2.

Threatened and Endangered Species

The absence of prairie dog towns in the vicinity of proposed roads precludes the possible occurrence of the black-footed ferret. Although bald eagles could occur over the entire area, nests and winter roosts are absent in the vicinity (Wyoming Game and Fish Department 1980a). No federally listed or proposed threatened or endangered plant taxa occur in the vicinity of the proposed roads.

TABLE 2-26

ACREAGES OF VEGETATION THAT WOULD BE DISTURBED BY CONSTRUCTION OF ACCESS ROADS IN THE SOUTH WELL FIELD[a]

Access Road	Distance (miles)	Acres	Vegetation Habitat Type
Beginning T. 32 N., R. 73 W., Sec. 6 Terminating T. 33 N., R. 73 W., Sec. 32	0.4	4.8	Prairie grassland
T. 32 N., R. 74 W., Sec. 12	0.2	2.4	Prairie grassland
T. 32 N., R. 74 W., Sec. 13	0.1	1.2	Prairie grassland
T. 32 N., R. 73 W., Sec. 8	0.3	3.6	Prairie grassland
TOTAL	1.0	12.0	

[a]Assumes a 100-foot-wide road corridor.

TABLE 2-27

ACREAGES OF VEGETATION THAT WOULD BE DISTURBED BY CONSTRUCTION OF ACCESS ROADS IN THE NORTH WELL FIELD[a]

Access Road	Distance (miles)	Acres	Vegetation Habitat Type
From Mortons 14	0.6	7.3	Prairie grassland
From Mortons 12	0.2	2.4	Prairie grassland
From Mortons 16	0.2	2.4	Prairie grassland
From Mortons 17	1.1	13.3	Prairie grassland
From Mortons 13	0.4	4.8	Prairie grassland
From Mortons 2	0.8	9.7	Prairie grassland
From Plant Site	0.8	9.7	Prairie grassland
From Mortons 4	0.2	2.4	Prairie grassland
From Mortons 3	0.2	2.4	Prairie grassland
From Mortons 7	1.1	13.3	Prairie grassland
From Mortons 8	0.4	4.8	Prairie grassland
From Mortons 11	0.4	4.8	Prairie grassland
From Mortons 10	0.6	7.3	Prairie grassland
From Pump Station	0.6	7.3	Prairie grassland
TOTAL	7.6	91.9	

[a]Assumes a 100-foot-wide road corridor.

2.B. MINE AND ASSOCIATED FACILITIES

2.B.1 MINE

Vegetation

The proposed Rochelle Mine site would occupy approximately 6,550 acres; Table 2-28 presents a breakdown of this area by vegetation type. For purposes of this Technical Report, the Rochelle Mine site has been divided into five vegetation habitat types based on 1:80,000-scale aerial photography and data from Econ Inc. (1980a).

A species list of plant taxa collected on the Rochelle Mine site by Econ Inc. (1980b) appears in Table 2-29. Kuchler (1966) described the potential natural vegetation of southeastern Campbell County as the wheatgrass-needlegrass (Agropyron-Stipa) grassland region. Soils in the vicinity of the Rochelle Mine site consist of shallow Torriorthents and Haplargids-Paleargids-Torriorthents associations (University of Wyoming Agricultural Experiment Station 1977). The Haplargids-Paleargids-Torriorthents association occurs on nearly level rolling upland plains, terraces, and fans. The shallow Torriorthents association is characteristic on steep uplands. Vegetation on both of these soil associations is typically grass-shrub, and grazing and wildlife habitat are the principal land uses (University of Wyoming Agricultural Experiment Station 1977).

The upland grass habitat type is characteristic of the northern portion of the site and covers approximately 35 percent of the mine. Grass dominance is shared by western wheatgrass, blue grama, needle-and-thread, and prairie junegrass (Econ Inc. 1980b). Forb cover is low, according to Econ Inc. (1980b), with fringed sagewort and scarlet globemallow being the most common forbs in the upland grass habitat type. Big sagebrush and plains pricklypear are dominant shrubs on

TABLE 2-28

APPROXIMATE ACRES OF EACH VEGETATION HABITAT TYPE WITHIN THE ROCHELLE MINE SITE[a]

Vegetation Habitat Type	Acres
Upland Grass	2,279
Breaks	2,751
Scoria	1,348
Ponderosa Pine Forest[b]	93
Playa[c]	79
Total Acres -	6,550

Source: Econ Inc. 1980b.

[a]Vegetation habitat type acreages were estimated using 1:80,000 scale aerial photography and data from Econ Inc. (1980b).

[b]Located on ridges in the scoria habitat type.

[c]Located within the upland grass habitat type in the northeastern section of the proposed mine.

TABLE 2-29

PLANT TAXA FROM CAMPBELL COUNTY, WYOMING

Forage Class	Scientific Name	Common Name
Grasses:	Agropyron cristatum	Crested wheatgrass
	Agropyron smithii	Western wheatgrass
	Agropyron spicatum	Bluebunch wheatgrass
	Agropyron species	Wheatgrass
	Aristida longiseta	Red threeawn
	Bouteloua gracilis	Blue grama
	Bromus japonicus	Japanese chess
	Bromus tectorum	Cheatgrass
	Calamagrostis montanensis	Plains reedgrass
	Calamovilfa longifolia	Prairie sandreed
	Carex eleocharis	Needleleaf sedge
	Carex filifolia	Threadleaf sedge
	Koeleria cristata	Prairie junegrass
	Oryzopsis hymenoides	Indian ricegrass
	Poa pratensis	Kentucky bluegrass
	Poa sandbergii	Sandberg bluegrass
	Schedonnardus paniculatus	Common tumblegrass
	Schizachyrium scoparium	Little bluestem
	Stipa comata	Needle-and-thread
	Stipa viridula	Green needlegrass
	Vulpi octoflora	Common sixweeksgrass
Forbs:	Achillea millefolium	Common yarrow
	Artemisia frigida	Fringed sagewort
	Aster species	Aster
	Astragalus species	Milkvetch
	Cirsium undulatum	Wavyleaf thistle
	Cryptantha bradburiana	Miner's candle
	Eriogonum multiceps	Eriogonum
	Erysimum asperum	Plains wallflower
	Gaura coccinea	Scarlet gaura
	Grindelia squarrosa	Curlycup gumweed
	Haplopappus spinulosa	Spiny goldenweed
	Heterotheca villosa	Hairy golden star
	Kochia scoparia	Fireweed summercypress
	Leucocrinum montanum	Common starlily
	Lithospermum incisum	Narrowleaf gromwell
	Mammillaria vivipara	Pink pincushion cactus
	Oxytropis lambertii	Purple point loco
	Oxytropis species	Loco
	Penstemon species	Penstemon
	Petalostemon purpureum	Purple prairie clover

TABLE 2-29 Concluded

PLANT TAXA FROM CAMPBELL COUNTY, WYOMING

Forage Class	Scientific Name	Common Name
Forbs (cont.)	Phlox hoodii	Hood's phlox
	Plantago patagonica	Wooly plantain
	Plantago spinulosa	Spiny plantain
	Psoralea argophylla	Silverleaf scurfpea
	Psoralea esculenta	Common breadroot scurfpea
	Ratibida columnifera	Prairie coneflower
	Sphaeralcea coccinea	Scarlet globemallow
	Taraxacum officinale	Common dandelion
	Thermopsis rhombifolia	Prairie thermopsis
	Tragopogon dubius	Salsify
	Vicia americana	American vetch
Shrubs and Half-shrubs:	Artemisia tridentata	Big sagebrush
	Atriplex canescens	Fourwing saltbush
	Atriplex species	Saltbush
	Ceretoides lanata	Common winterfat
	Chrysothamnus nauseosus	Rubber rabbitbrush
	Oenothera serrulata	Shrubby evening primrose
	Opuntia polyacantha	Plains pricklypear
	Rosa woodsii	Wood's rose
	Xanthocephalum sarothrae	Broom snakeweed
	Yucca glauca	Soap-weed

Source: Econ Inc. 1980b.

upland sites (Econ Inc. 1980b). Plains cottonwoods are scattered along the heads of drainages on the site; however, only 34 individual trees were recorded by Econ Inc. (1980b).

Range conditions on upland grass sites at the Rochelle Mine site were considered good by Econ Inc., with annual production estimated at 506 lbs/acre. The recommended stocking rate in this type is 0.33 AUM/acre. Total upland grass type AUMs on the Rochelle Mine site are estimated to be approximately 778 (Table 2-30).

Seventy-nine acres in the northern sections of the proposed mine site are considered playa vegetation. Alkali sacaton, foxtail, western wheatgrass, inland saltgrass, greasewood, and Nuttall saltbush occur in most of these areas (Ecology Consultants, Inc. 1975c). In Table 2-30, this acreage is included with upland grass for AUM calculations.

The breaks area consists of steep, blue to gray shale slopes that drop abruptly from the flat uplands (Econ Inc. 1980b). A high degree of erosion on these breaks produces numerous small areas of bare ground, evident in aerial photographs. Dominant grasses on the breaks are western wheatgrass, blue grama, and needle-and-thread, with bluebunch wheatgrass and green needlegrass as subdominants (Econ Inc. 1980b). Forbs include eriogonum, Hood's phlox, and prairie thermopsis. Big sagebrush, rubber rabbitbrush, and fourwing saltbush are the dominant shrubs in the breaks area (Econ Inc. 1980b). According to Econ Inc.'s data, range condition is fair on the 10 range sites sampled in the breaks type. Annual production on the breaks within the mine site is 385 lb/acre and the grazing capacity is 0.10 AUM/acre. Approximately 275 AUMs occur on the breaks on the site (Table 2-30).

TABLE 2-30

RANGE CONDITION AND CARRYING CAPACITY BY RANGE SITE FOR VEGETATION TYPES ON THE ROCHELLE MINE SITE

Vegetation Type	Permit Area Annual Production[a] (lb/acre)	Range Condition	Vegetation Type Acreage Mine Site	Carrying Capacity[a] (AUMs/acre)	Total AUMs
Upland Grass	506	Good	2,358[b]	0.33	778
Breaks	385	Fair	2,751	0.10	275
Scoria	402	Fair	1,348	0.05	67
Ponderosa Pine	---	----	93	0.10[c]	9
			Total - 6,550		Total - 1,129

[a]Estimates of annual production range condition and carrying capacity were taken from Econ Inc. (1980a).

[b]Playa acreages included as upland grass vegetation habitat for AUM calculations.

[c]The estimate of the carrying capacity of the ponderosa pine-covered ridges were made using range site data for similar habitats in the vicinity of the Rochelle Mine site provided by Terry Matchett, BLM, Powder River Resource Area, Casper.

The scoria vegetation type occupies moderate to steep slopes where exposed coal seams burned, resulting in reddish, rocky soil (Econ Inc. 1980b). The scoria type covers nearly 21 percent of the site. Dominant grass species include blue grama, needle-and-thread, threadleaf sedge, and bluebunch wheatgrass. Dominant forbs (high cover or high frequency) are fringed sagewort, Hood's phlox, silver-leaf scurfpea, and scarlet globemallow. Big sagebrush and plains pricklypear are dominant shrubs. Range conditions are fair, and grazing permit areas typically produce 402 lb/acre annually (Econ Inc. 1980a). Grazing capacity is 0.05 AUM/acre; consequently, a total of 67 AUMs exist in this type on the proposed mine site.

Approximately 93 acres of ponderosa-pine-covered ridges occur on the southern end of the proposed mine site. Tree cover averages 24 trees/acre. This type was considered a subtype of the scoria type by Econ Inc. (1980b). In this report it is treated as a separate vegetation/habitat type for two reasons: first, according to range site data from similar tree-covered ridges near the proposed mine, the carrying capacity of this habitat type is twice that of the scoria type (Table 2-30); second, this vegetation type, when considered as wildlife habitat, is quite different from the scoria type. Carrying capacity of ponderosa pine on the site is near 0.10 AUM/acre (Matchett 1981), and on the mine site this vegetation type supports a total of approximately 9 AUMs.

<u>Terrestrial Wildlife</u>

Wildlife species that could occur in the vicinity of the proposed mine site are listed in Appendix A (Tables A-4, A-5, and A-6). These lists were constructed from distribution data provided by Long (1965), Oakleaf et al. (1979), and Baxter and Stone (1980).

<u>Big Game</u>. Four species of big game occur on or in the immediate

vicinity of the Rochelle Mine site: pronghorn antelope, mule deer, elk, and white-tailed deer.

Antelope are the most abundant big game in the area (Econ Inc. 1980a). A Wyoming Game and Fish Department distribution map (1980a) indicates that the mine area is used year-round by antelope (Econ Inc. 1980a). However, no critical antelope habitat areas occur in the general vicinity (Wyoming Game and Fish Department 1980a). Sixty-seven percent of all antelope observations on the mine site occurred in the upland grass type, and statistical analysis indicated a significant positive preference for this type (Econ Inc. 1980a). Antelope were observed less frequently in the breaks area. Econ Inc. observed that, although pronghorn used the entire mine site to some degree year-round, a large portion of the population appeared to winter elsewhere.

Mule deer are common but not abundant on the site (Econ Inc. 1980a). The site lies in the Wyoming Game and Fish Department's Thunder Basin herd unit. In 1976, this deer herd provided a harvest of 3,800 animals and the total herd size was estimated to be 11,000 animals (Wyoming Game and Fish Department 1978). Deer within this herd unit utilize creek bottoms, steep canyons, and rough rolling breaks during most of the year; timbered ridges and riparian areas, where available, are also used (Wyoming Game and Fish Department 1978). During winter, mule deer tend to concentrate along timbered creek bottoms. They also tend to prefer these sheltered creek bottoms as fawning areas. According to the Wyoming Game and Fish Department (1978), drainage areas are the "hub of existence" for the Thunder Basin mule deer herd unit.

On the Rochelle Mine site in 1978, autumn observations revealed a fawn:doe ratio of 78:100 (Econ Inc. 1980a), which is considered fair by Eustace (1971). No critical mule deer habitat occurs within, or in the general vicinity of, the mine site (Wyoming Game and Fish Department 1980a). Distribution is basically limited to riparian habitat along Antelope Creek and to the steep ponderosa pine covered ridges on the breaks along the southern and southeastern edges of the site (Econ Inc. 1980a).

During autumn, when the surrounding range is dry, mule deer forage along Antelope Creek and in the nearby alfalfa field. The protective cover of the ponderosa pine covered ridges is used most during the winter season (Econ Inc. 1980a). During the spring, the upland grass type is preferred, and the riparian habitat along Antelope Creek is used extensively in the summer months.

Elk are considered uncommon at the mine site, although according to Tom Kombarak (U.S. Forest Service), 20-40 elk inhabit the Rochelle Hills immediately east of the site (Econ Inc. 1980a). Elk were sighted only in the extreme eastern edge of the site during Econ's studies. White-tailed deer are sighted infrequently in the riparian habitat along Antelope Creek (Econ Inc. 1980a). Preferred ranges of both these species occur off the proposed mining area. No critical elk or white-tailed deer habitat occurs on or in the vicinity of the site (Wyoming Game and Fish Department 1980a).

<u>Upland Game Birds</u>. The only upland game bird species observed during Econ's surveys of the site was sage grouse, although sharp-tailed grouse are known to inhabit and breed in the Area containing the site (Oakleaf et al. 1979). According to Econ Inc. (1980a), sage grouse are not abundant on the site.

Sage grouse hunting pressure in Campbell County, Wyoming, is relatively light. In 1979, an estimated 91 hunters spent 200 days taking 294 grouse (Wyoming Game and Fish Department 1980c).

Sage grouse breed on strutting grounds or leks in early spring. In Wyoming, strutting activity usually occurs from late February to mid-March (Harju 1979). Sage grouse leks are used, usually by the same birds, year after year, and according to Harju (1979), open sagebrush is preferred for strutting activities. These leks are often found on wind-swept ridges, exposed knolls, bare spots in the midst of dense sagebrush, or in areas of scattered sagebrush adjacent to denser stands. Harju reports that sage grouse have been known to return to strut on roads, airport runways, and pipelines after the areas were developed.

Econ Inc. (1980a) searched for sage grouse leks during March, April, and May. One lek was located on the proposed mine site on the edge of a playa within the upland grass type (Figure 2). The stands of big sagebrush are used by sage grouse for food and cover. Econ Inc. (1980a) counted 33 males on this lek, and pointed out that the sage grouse population on the site is not very high, and has been declining due to brush control practices.

Waterfowl. Econ Inc. (1980a) recorded 10 species of waterfowl in the vicinity of the mine site; most observations were made on Porcupine Reservoir and smaller stock ponds. Puddle ducks were the most commonly observed species. Large numbers of waterfowl ~~use~~ Porcupine Reservoir, probably the best habitat in the area. Stock pond use is low and less frequent. Other waterfowl observed in the area by Econ Inc. (1980a) included pintail, gadwall, American widgeon, eared grebe, and sandhill cranes.

Raptors. Twelve species of raptors were observed in the area by Econ Inc. (1980a). The most common was the American kestrel (Falvo spaverinus). The kestrel appears to mate for life and return season after season to the same eyrie site, even when persistently disturbed (Williams and Matteson 1973). The sexes usually pair off in late April, and the most frequently selected nest sites are the abandoned holes of flickers and other woodpeckers, as well as natural cavities in trees. The clutch usually averages four or five. Incubation takes 29 to 30 days, and the young fledge in about three or four weeks (Eyre and Paul 1973).

Golden eagles (Aquila chrysaetos) were the second most commonly observed raptor on the Rochelle Mine site (Econ Inc. 1980a). A congressional amendment to the federal Protection of Bald Eagles Act of 1940 now provides protection for both species of native American eagles. Essentially, the important provisions of this act protect golden eagles and their nests from any form of depredation.

Williams and Matteson (1973) reported that of the 14 known golden eagle eyries in southeastern Wyoming, only 2 were located in trees, and both were in tall pines. Other eyries were located in a variety of habitats ranging from the ledges of high, sheer cliffs to niches in low mud banks. Golden eagles typically maintain alternate nests near the primary site. Use of these alternate nests varies from one to three years.

In Wyoming, golden eagles typically produce two eggs as early as late February, but the majority are found later in March (Williams and Matteson 1973). Eggs are deposited in a lined hollow in the foundation of nest sticks, and hatch in approximately 35 to 37 days. Both parents incubate the eggs, and the young are fledged in 60 to 70 days (Eyre and Paul 1973).

Golden eagles are diurnal hunters, and each pair may require as much as 20 to 30 square miles of territory (Eyre and Paul 1973). Golden eagles subsist mainly on a diet of jackrabbits, cottontails, marmots, ground squirrels, prairie dogs, and spermophiles (Williams and Matteson 1973). In the vicinity of the proposed mine site, golden eagles feed on prairie dogs and white-tailed jackrabbits (Econ Inc. 1980a).

Five golden eagle nests were located by Econ Inc. (1980a) at or near the proposed Rochelle Mine site; three of these were active during the 1979 nesting season (Figure 2). One of the active eyries was located along Porcupine Creek directly east of the proposed railroad loop (Econ Inc. 1980a). Two nests were within the mine lease boundary: one was active in 1979 and one was inactive.

Various other raptors have been reported on or near the site, including great horned owls (Bubo virginianus), rough-legged hawks (Buteo lagopus), ferruginous hawks (Buteo regalis), red-tailed hawks (Buteo famaicensis), Swainson's hawks (Buteo swainsoni), and turkey vultures (Cathartes aura).

Lagomorphs and Small Mammals. Econ Inc. (1980a) collected small mammals from the proposed Rochelle Mine site during August 1979. The most abundant small mammal was the western deer mouse. Other species collected in the vicinity of the mine site included the Ord kangaroo rat, least chipmunk (Eutamius minimus), prairie vole, northern grasshopper mouse, olive-backed pocket mouse, white-footed mouse (Peromuscus leucopus), western harvest mouse (Reithrodontomys megalotis), and thirteen-lined ground squirrel. Econ Inc. (1980a) obtained small mammal population estimates from upland grass habitat (11/acre) and from the rough brakes area (35/acre). During the August

studies, no small mammals were collected from scoria habitat on the mine. However, during October 1978 and May 1979 surveys the western deer mouse, olive-backed pocket mouse, prairie vole, Ord kangaroo rat, northern grasshopper mouse, and thirteen-lined ground squirrel were all either trapped or observed in this type.

During June and August 1973, Ecology Consultants, Inc. (1974a) estimated lagomorph densities at the proposed mine site. During June, the estimate for cottontails and jackrabbits combined was 127/square mile. During August, the combined estimate was 398/square mile.

Aquatic Biology

The aquatic habitat on the proposed mine site lies within the Cheyenne River drainage (Baxter and Simon 1970). The aquatic habitat in the vicinity of the site is limited to School, Porcupine, Beckwith, and Piney creeks, two unnamed tributaries of Little Thunder Creek, an unnamed tributary of Antelope Creek, and several unnamed pools. All of these streams are intermittent. The pools are small gully-plug reservoirs and playas that often dry up during periods of no precipitation.

Reservoirs in the proposed mine site were sampled for chemical and physical constituents, trace elements, zooplankton, and benthic invertebrates during 1973 (WyCoalGas 1974). A summary of physicochemical data is presented in Table 2-31. Dissolved oxygen ranged from 5 to 14 milligrams/liter (mg/l); marginal conditions for aquatic life would exist at the lower value of 5 mg/l (U.S. Environmental Protection Agency 1976a). Concentrations of nitrates ranged from 0.08 to 2.4 mg/l; the higher value was reported from a spring-fed stock-watering station. Sulfate concentrations ranged from 30 mg/l during early portions of the summer to 625 mg/l during the latter portion of the summer; the high concentrations of sulfate may contribute to

TABLE 2-31

RANGES OF THE CHEMICAL AND PHYSICAL CHARACTERISTICS OF STANDING SURFACE WATERS ON THE MINE AREA IN THE SUMMER OF 1973

Elements	Concentrations
Dissolved Oxygen (DO; mg/l)	5-10
Nitrate (NO_3; mg/l)	0.08-2.4
Sulfate (SO_4; mg/l)	30-625
Total alkalinity (as $CaCO_3$; mg/l)	0-75
Total hardness (as $CaCO_3$; mg/l)	55-440
Turbidity (JTU)	0-1050
Temperature (°C)	
Surface	9-24.5
10" depth	12-22
pH	7.0-9.8

Source: WyCoalGas 1974.

salinity problems. Alkalinity values were reported from 0 to 75 mg/1, although WyCoalGas reported that the lower value may have resulted from reagent deterioration during one sampling period. Values for pH ranged from 7.0 (neutral) to 9.8 (alkaline). Waters of the reservoirs ranged from soft (55 mg/1) to very hard (440 mg/1). High levels of sulfates were reported from reservoirs with the high levels of hardness. Low levels of turbidity (0 Jackson Turbidity Units [JTU]) were reported during June at a spring-fed reservoir, while high turbidity (1,050 JTU) was reported during August at another reservoir. Trace element concentrations from combined water samples at the mine site are reported in Table 2-32. Zooplankton were collected from reservoirs on the mine site; taxa collected are reported in Table 2-33.

Benthic invertebrates were also collected during summer and are listed in Table 2-34. Ectoprocta (moss animals) have been found in unpolluted and unsilted waters, especially ponds and the shallows of lakes (Pennak 1978). Tubificids are often found in bottom sediments with low oxygen concentrations. Leeches require substrates to which they can adhere; thus, they are uncommon on predominantly mud or clay bottoms. Their distribution may also be limited by low calcium concentrations.

Snails were found in great abundance throughout the study sites on the proposed mine. Fingernail clams were also collected. Insects, including larval stages of mayflies, damselflies, and midges, were reported. The adult stages of these organisms are terrestrial. Beetles and true bugs which spend all of their lives associated with water were also reported from the reservoir. Fathead minnows were seen in a mine area reservoir during 1973 but were not collected.

The intermittent streams in the mine area were not sampled during the WyCoalGas 1973 survey. These streams are a part of the Cheyenne

TABLE 2-32

TRACE ELEMENTS IN WATER SAMPLES COLLECTED IN THE MINE AREA IN THE SUMMER OF 1973

Element	Concentration (μg/ml)
Uranium	<.020
Thorium	<.100
Bismuth	.020
Lead	.090
Mercury	<.001
Osmium	<.060
Lanthanum	.027
Barium	.020
Antimony	<.020
Tin	.540
Cadmium	.040
Silver	<.020
Rhodium	<.010
Ruthenium	<.030
Molybdenum	.050
Strontium	.330
Selenium	.990
Arsenic	.017
Germanium	<.030
Gallium	.880
Zinc	.068
Copper	.500
Nickel	.030
Cobalt	.033
Iron	9.800
Manganese	.140
Chromium	.086
Vanadium	.140
Titanium	18.000
Calcium	17.000
Potassium	12.000
Chlorine	<1.000
Sulfur	18.000
Phosphorus	7.300
Silicon	9.100
Aluminum	54.000
Magnesium	9.200
Sodium	4.600
Fluorine	3.600
Boron	1.300
Beryllium	<.001

Source: WyCoalGas 1974.

TABLE 2-33

ZOOPLANKTON TAXA IDENTIFIED FROM THE PLAYAS AND GULLY-PLUG RESERVOIRS ON THE MINE AREA IN THE SUMMER OF 1973

Rotifera (rotifers)

- *Keratella valga*
- *Conochilus* sp.
- *Brachionus* sp.

Cladocera (water fleas)

- *Daphnia schodleri*
- *Moina rectirostris*
- *Bosmina coregoni*
- *Chydorus sphaericus*
- *Leydigia quadrangularis*
- *Pleuroxus trigonellus*
- *Ceriodaphnia pulchella*
- *Simocephalus vetulus*
- *Alona guttata*
- *Scapholebris kingi*

Copepoda (copepods)

- *Acanthocyclops vernalis*
- *Cyclops varicans rubellus*
- *Diaptomus clavipes*
- *Eucyclops agilis*
- *Macrocyclops* sp.

Source: WyCoalGas 1974.

TABLE 2-34

BENTHIC TAXA IDENTIFIED FROM THE STOCK PONDS AND GULLY-PLUG RESERVOIRS ON THE MINE IN THE SUMMER OF 1973

Common Name	Scientific Name
Moss animals	Ectoprocta
	Phylactolaemata
	Fredericellidae
	Fredericella sp.
	Plumatellidae
	Plumatella sp.
Segmented worms	Annelida
Aquatic earthworms	Oligochaeta
	Plesopora
Sludge worms	Tubificidae
	Tubiflex sp.
Leeches	Hirudinea
	Rhynchobdellida
Snail Leeches	Glossiphonidae
	Placobdella sp.
	Helobdella sp.
Mollusks	Mollusca
Clams	Pelecypoda
	Heterodonta
Fingernail claims	Sphaeriidae
	Musculium sp.
Snails	Gastropoda
Lunged snails	Pulmonata
	Physidae
	Physa sp.
	Planorbidae
	Gyraulus sp.
Arthropods	Arthopoda
Insects	Insecta
Mayflies	Ephemeroptera
	Baetidae
	Baetis sp.
	Ametropidae
	Ametropus sp.
	Caenidae
	Caenis sp.
Damselflies, Dragonflies	Odonata
Damselflies	Zygoptera
	Coenagrionidae
	Ischnura sp.

TABLE 2-34 Concluded

BENTHIC TAXA IDENTIFIED FROM THE STOCK PONDS AND GULLY-PLUG RESERVOIRS ON THE MINE IN THE SUMMER OF 1973

Common Name	Scientific Name
Beetles	Coleoptera
Predaceous diving beetles	Dytiscidae
Bugs	Hemiptera
Backswimmers	Notonectidae
	Notonecta sp.
True flies	Diptera
Midges	Chironomidae

Source: WyCoalGas 1974.

River basin (Baxter and Simon 1970). School, Piney, and two of the unnamed streams on the mine site are tributaries of Little Thunder Creek. The remaining streams are tributaries of Antelope Creek. These streams were classified by the U.S. Fish and Wildlife Service and Wyoming Game and Fish Department (1978). A permanent fish fauna would probably not be present, although fishes may be present if deep pools on the mine site remain water year-round. Small populations of fishes would be expected during periods of flow.

The water quality of School Creek was examined by Wesche and Johnson (1980) and was not considered good. High salinity and boron concentrations were reported. Dissolved solids concentrations were sufficiently elevated to be detrimental to all but the most resistant organisms (U.S. Environmental Protection Agency 1976a; Wesche and Johnson 1980). The low-gradient, shallow, sluggish streams with vast fluctuations in flow, temperature, and dissolved oxygen result in an aquatic fauna that is tolerant of a wide range of environmental conditions. The aquatic fauna can generally be classified as warm-water forms.

Water quality of Little Thunder Creek is more favorable for aquatic fauna, although it was reported that total iron exceeded the criterion for aquatic life forms in April 1978. Little Thunder Creek was reported to be the least buffered of the four streams that were surveyed.

Fishes collected from School and Little Thunder creeks by Wesche and Johnson (1980) are listed in Table 2-35. Four game fishes were collected in the basin: black bullhead, green sunfish, bluegill, and largemouth bass. The source of the bass and bluegill in Little Thunder is probably Reno Reservoir. Wesche and Johnson (1980) reported that natural reproduction was occurring in Reno Reservoir since all

TABLE 2-35

FISHES COLLECTED FROM SCHOOL AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
Minnows	Family Cyprinidae
Fathead minnow	_Pimephales promelas_
Suckers	Family Catostomidae
White sucker	_Catostomus commersoni_
Catfishes	Family Ictaluridae
Black bullhead	_Ictalurus melas_
Sunfishes	Family Centrarchidae
Green sunfish	_Lepomis cyanellus_[a]
Bluegill	_Lepomis macrochirus_[a]
Largemouth bass	_Micropterus salmoides_[a]

Source: Wesche and Johnson 1980.

[a]Collected only from Little Thunder Creek.

the bass collected were young-of-the-year. School Creek was visited during September 1976 by Wesche and Johnson (1980); a few shallow (0.5 ft), scattered pools were noted. A limited fisheries potential exists in School and Little Thunder creeks from the ground water-fed ponds scattered throughout the creeks.

Benthic invertebrates were also surveyed by Wesche and Johnson (1980). A taxonomic list of the benthos collected from School and Little Thunder creeks is presented in Table 2-36. The benthos were characterized as forms that tolerated a wide range of environmental conditions. Diversities, using numbers and biomass, for School and Little Thunder creeks were estimated using the Shannon-Weaver Index. The mean numerical diversity for School Creek was 1.72, while the biomass diversity was 0.71. The mean numerical and biomass diversities for Little Thunder Creek were 1.92 and 1.52, respectively. Stream conditions may be correlated with diversity index: Excellent = 3-4, Good = 2-3, Fair = 1-2, and Poor = <1 (Wesche and Johnson 1980).

Porcupine Creek, Beckwith Creek, and two unnamed drainages are part of the Antelope Creek drainage. None of these drainages were sampled by Wesche and Johnson (1980), except the main stem of Antelope Creek.

Water quality for Antelope Creek was intermediate compared with that reported for School and Little Thunder creeks. The dissolved solids concentrations were acceptable for irrigation use. High concentrations of iron and manganese may indicate that the water is unsuitable for agriculture and some industrial uses. High levels of suspended solids were reported after a spring thunderstorm. Wesche and Johnson (1980) reported evidence of erosion potential in the surrounding area.

TABLE 2-36

TAXONOMIC CLASSIFICATION OF THE BENTHIC FAUNA OF SCHOOL AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
Freshwater shrimp	Amphipoda
	Talitridae
	Hyallela azteca[a]
Water mites	Hydracarina
	Limnocharidae
	Limnochares sp.
Segmented worms	Annelida
Aquatic earthworms	Oligochaeta
	Tubificidae
Leeches	Hirudinea
	Glossiphoniidae
Mollusks	Mollusca
Snails	Gastropoda
	Physidae
	Physa sp.
	Lymnaeidae
	Lymnaea sp.
	Ancylidae
	Ferrissia sp.
	Planoribidae
	Gyraulus sp.
Clams	Pelecypoda
	Sphaeriidae
	Sphaerium sp.[b]
Insects	Insecta
Mayflies	Ephemeroptera
	Caenidae
	Caenis sp.
Damselflies, Dragonflies	Odonata
Damselflies	Zygoptera
	Coenagrionidae
	Ischnura sp.[b]
	Argia sp.

TABLE 2-36 Concluded

TAXONOMIC CLASSIFICATION OF THE BENTHIC FAUNA OF SCHOOL AND LITTLE THUNDER CREEKS

Common Name	Scientific Name
Caddisflies	Trichoptera
	Phryganeidae[a]
	Phryganea sp.
	Limnephilidae
	Limnephilus sp.
	Psychomyiidae
	Polycentropus sp.
Beetles	Coleoptera
Riffle beetles	Elmidae
	Dubiraphia sp.
Crawling water beetles	Haliplidae
	Haliplus sp.
Water scavenger beetles	Hydrophilidae
	Berosus sp.
Flies	Diptera
Midges	Chironomidae
	Chironomus sp.
	Pentaneura sp.
Biting midges	Ceratopogonidae
	Palpomyia sp.
Horseflies	Tabanidae
	Chrysops sp.
Mosquitoes, Phantom midges	Culicidae
	Chaoborus sp.

Source: Wesche and Johnson 1980.

[a]Collected only from School Creek.

[b]Collected only from Little Thunder Creek.

Fishes collected by Wesche and Johnson (1980) from Antelope Creek are presented in Table 2-37; it is anticipated that some of these fishes would be present in the drainages on the mine site. Two game fishes were among those collected from Antelope Creek: black bullhead and green sunfish.

Benthic invertebrates were collected from Antelope Creek; the taxonomic list is presented in Table 2-38. As with the fishes, it is anticipated that the invertebrate fauna in the mine area drainages would be similar to that reported in the main portion of Antelope Creek. Two sites were sampled on Antelope Creek; the mean annual numerical diversities were estimated as 2.33 and 1.21. The mean annual biomass diversities were estimated as 1.75 and 1.15. The numerical diversities that were reported would be correlated to good (2-3) and fair (1-2) stream conditions. The diversities reported for biomass indicate fair stream conditions (Wesche and Johnson 1980).

Threatened and Endangered Species

Econ Inc. (1980a) and Kombarak (1980) reported that prairie dog colonies occur near the mine site, although none were known to occur within the lease boundaries. However, May 1981 aerial surveys of the mine site located a dog town in the middle of the proposed mine site. Consequently, potential black-footed ferret habitat exists on the mine site. Surveys of prairie dog colonies revealed no positive sign that ferrets occur in the area (Econ Inc. 1980a).

Although no bald eagle nests occur near the site (Wyoming Game and Fish Department 1980a), a relatively large communal roost occurs roughly 2.5 miles to the south. Williams and Matteson (1973) stated that the peregrine falcon is not common as a summer resident in Wyoming, being more frequently encountered as a migrant. No federally listed, proposed, or status review plant taxa are known to occur in

TABLE 2-37

FISHES COLLECTED FROM ANTELOPE CREEK

Common Name	Scientific Name
Minnows	Cyprinidae
Carp	_Cyprinus carpio_
Flathead chub	_Hybopsis gracillis_
Longnose dace	_Rhinichthys cataractae_
Sand shiner	_Notropis stramineus missuriensis_
Fathead minnow	_Pimephales promelas_
Plains minnow	_Hybognathus placitus_
Suckers	Catostomidae
White sucker	_Catostomus commersoni_
Catfishes	Ictaluridae
Black bullhead	_Ictalurus melas_
Sunfishes	Centarchidae
Green sunfish	_Lepomis cyanellus_
Killifishes	Cyprinodontidae
Plains killifish	_Fundulus zebrinus_

Source: Wesche and Johnson 1980.

TABLE 2-38

TAXONOMIC CLASSIFICATION OF BENTHIC FAUNA FROM ANTELOPE CREEK

Common Name	Scientific Name
Fresh-water shrimp	Amphipoda
	Talitridae
	Hyallela azteca
Water mites	Hydracarina
	Limnocharidae
	Limnocgares sp.
Segmented worms	Annelida
Aquatic earthworms	Oligochaeta
	Tubificidae
Leeches	Hirudinea
	Glossiphoniidae
Mollusks	Mollusca
Snail	Gastropoda
	Physidae
	Physa sp.
	Lymnaeidae
	Lymnaea sp.
Clams	Pelecypoda
	Sphaeriidae
	Sphaerium sp.
Insects	Insecta
Mayflies	Ephemeroptera
	Caenidae
	Caenis sp.
Damselflies, Dragonflies	Odonta
Damselflies	Zygoptera
	Coenagrionidae
	Ischnura sp.
	Argia sp.
Dragonflies	Anisoptera
	Libellulidae
	Somatochlora sp.
Caddisflies	Trichoptera
	Psychomyiidae
	Polycentropus sp.
	Limnephilidae
	Limnephilus sp.

TABLE 2-38 Concluded

TAXONOMIC CLASSIFICATION OF BENTHIC FAUNA FROM ANTELOPE CREEK

Common Name	Scientific Name
Beetles	Coleoptera
Riffle beetles	Elmidae
	Dubiraphia sp.
Water scavenger beetles	Hydrophilidae
	Berosus sp.
Predaceous diving beetles	Dytiscidae
	Hydaticus sp.
Crawling water beetles	Haliplidae
	Haliplus sp.
Flies	Diptera
Midges	Chironomidae
	Chironomus sp.
	Pentaneura sp.
Biting midges	Ceratopogonidae
	Palpomyia sp.
	Dasyhela sp.
Horseflies	Tabanidae
	Chrysops sp.
	Tabanus sp.
Mosquitoes, Phantom midges	Culicidae
	Chaoborus sp.
Long-legged flies	Dolichopodidae
Soldier flies	Stratiomyidae

Source: Wesche and Johnson 1980.

the vicinity of the proposed mine.

2.B.2 TRANSMISSION LINES (Awaiting Project Description Information)

2.B.3 ACCESS ROAD

Vegetation

The access road on the proposed Rochelle Mine site would traverse 4.9 miles of prairie grassland vegetation. Along Porcupine Creek, several large cottonwoods could be affected by construction of the mine-associated road.

Terrestrial Wildlife

Since for the most part the access road would traverse the mine site itself, reference is made to Section 2.B for a description of wildlife in the area.

Aquatic Biology

The aquatic environment in this region contains primarily intermittent streams and small reservoirs (see Section 2.B.1) lying within the Cheyenne River drainage. The only stream that would be traversed by the road in the proposed mine area is Porcupine Creek.

Threatened and Endangered Species

No bald eagle or peregrine falcon nests or winter roosts occur near the proposed access road corridor. Prairie dog towns would not be traversed by the proposed road. No federally listed, proposed, or status review plant taxa occur in the vicinity of the proposed road corridor.

2.C PRODUCT PIPELINE

Vegetation

The flora of eastern Wyoming is referred to as the Great Plains flora by Dorn (1977). According to Dorn, the Great Plains flora occurs in "lower elevations in the eastern one-third of the state"; he lists the following species as representative of this flora: Amorpha canescens, Calylophus serrulatus, Andropogen gerardii, Astragalus plattensis, Bouteloua curtipendula, Bucholoe dactyloides, Enchinacea angustifolia, Liatris punctata, Penstemon grandiflorus, Petalostemon purpurem, and Atipa spartea.

Kuchler (1966) divided the general area that would be traversed by the product pipeline into two potential natural vegetation zones. The product pipeline would traverse a grama-needlegrass-wheatgrass grassland (Bouteloua, Stipa, Agropyron) roughly north of Guernsey Reservoir and a grama-buffalograss grassland (Bouteloua, Buchloe) from that point south into northeastern Colorado (Kuchler 1966).

For the purposes of this report, Dorn's Great Plains flora has been divided further into the vegetative habitat types described below:

- Prairie Grassland and Prairie Grassland-Breaks Types: This type is a combination of the shortgrass and mixed prairie natural vegetation types described by Dorn (1977). Areas dominated by shortgrass species (i.e., Buchloe dactyloides, Bouteloua gracilis, Koeleria macrantha, and Carex filifolia) aretypical of flatter plains that receive moderate to heavy grazing pressure. Mixed prairie species (i.e., Andropogon sp., Agropyron sp., Bouteloua curtipendula, and Stipa sp.) occur in areas of rougher topography, and generally exist in the "mixed" state as a result of less grazing

pressure. This vegetation type has been described in detail in Section 2.A.1. The proposed inch product pipeline would traverse the 10 to 14- and 12 to 14-inch Northern Great Plains precipitation zones. The Soil Conservation Service's suggested stocking rates in these zones are tabulated in Tables 2-4 and 2-39, respectively, and vary from 0.2 AUM/acre on ranges in excellent condition to 0.05 AUM/acre on ranges in poor condition.

- Open Ponderosa Pine Forest, Open Ponderosa Pine Forest-Breaks, and Ponderosa Pine Forest Types: These vegetative types are variations, dependent on degree of canopy cover, of Dorn's (1977) ponderosa pine type. Typically, they occur on lower mountain slopes, foothills, and water-trapping rock formations in the plains. Representative species include *Pinus ponderosa* and *Arctostaphylos uvaursi*. Ponderosa pine and Rocky Mountain juniper dominate the overstory. The understory typically contains mountain mahogany, fringed sagewort, skunkbush, rose, blazing star, wild buckwheat, wheatgrasses, little bluestem, threeawn, sideoats grama, blue grama, prairie junegrass, and squirreltail. In areas with a more open canopy, the understory grassland is similar to Dorn's mixed prairie grassland type, previously described.

- Dry Stream Bottom Type: Because they are intermittent, most of the streams which would be traversed lack sufficient water to support a cottonwood riparian community. However, isolated willows are sometimes found. The dry stream bottom type includes those stream crossings that show little similarity to the surrounding vegetation type. Streambank vegetation generally includes willows, horsetail, bulrush,

TABLE 2-39

INITIAL STOCKING RATE IN THE 12-14 INCH NORTHERN PLAINS PRECIPITATION ZONE

Range Site AUMs/Acre	Range Condition (percent original vegetation) Excellent (76-100)	Good (51-75)	Fair (26-50)	Poor (0-25)
Wetland	3.0	2.5	1.5	1.0
Subirrigated	2.0	1.5	1.0	0.6
Saline Subirrigated	1.5	1.2	0.8	0.4
Loamy Upland	0.6	0.5	0.25	0.15
Sandy Lowland	0.6	0.5	0.25	0.15
Saline Lowland	0.5	0.4	0.15	0.10
Loamy Overflow	0.6	0.5	0.25	0.15
Clayey Overflow	0.6	0.5	0.25	0.15
Sands	0.4	0.3	0.2	0.1
Sandy	0.4	0.33	0.2	0.1
Loamy	0.4	0.33	0.2	0.1
Clayey	0.4	0.33	0.2	0.1
Choppy Sands	0.33	0.3	0.2	0.1
Gravelly Loamy	0.3	0.25	0.15	0.07
Limy Upland	0.25	0.2	0.15	0.1
Shallow Sandy	0.2	0.17	0.10	0.05
Shallow Loamy	0.2	0.17	0.10	0.05
Saline Upland	0.2	0.17	0.10	0.05
Gravelly	0.15	0.12	0.05	0.03
Very Shallow	0.15	0.12	0.05	0.03

Source: Wakkuri 1981.

and slender wheatgrass, with alkali sacaton and black greasewood occurring on more alkaline sites. In more rocky areas, ponderosa pine occurs near the stream banks. Along more sandy streambanks, wild licorice, two-grooved milk-vetch, broom snakeweed, spreading wild buckwheat, fringed sagewort, Indian ricegrass, and snowball sand verbena are common (Ecology Consultants, Inc. 1975b).

- Plains Cottonwood Type: This is a combination of Dorn's plains cottonwood and box elder-elm-ash types. Representative species include *Populus deltoides*, *Shepherdia argentea*, *Acer negundo*, *Ulmus americana*, and *Fraxinus pennsylvanica*. Ecology Consultants, Inc. (1975b), divided the North Platte River cottonwood riparian zone into two subtypes, a rush-bulrush community (*Juncus torreyi*/*Scirpus acutus*) that typically occupies wet areas adjacent to the river, and a dry streambank community dominated by perennial grasses and large cottonwoods. The understory is dominated by alkali sacaton, western wheatgrass, alkali cordgrass, and bulrush. Common weedy forbs include oakleaf, goosefoot, and bushy knotweed.

- Agricultural Lands: This category consists of plowed areas which may or may not be currently cultivated. Some of the agricultural lands which would be affected appear to be abandoned. Abandoned croplands are generally dominated by weedy species such as red threeawn, Russian thistle, and yellow salisfy. Older abandoned fields often resemble the original communities, with needle-and-thread, blue grama, western wheatgrass, and big sagebrush being typical invaders.

- Urban and Built-up Lands: This category includes any areas, including transportation corridors, which have been previously disturbed by construction activities.

Distances that would be traversed across vegetation types by the proposed product pipeline were evaluated using aerial photography, at a scale of 1 inch = 1,000 feet. A detailed analysis of vegetation along the proposed corridor is presented in Appendix C (Table C-1). A summary, by county, of averages and mileages affected in each type appears in Table 2-40.

Approximately 75 percent of the proposed corridor would cross open prairie grassland (including grassland on breaks). The majority of this segment (90 percent) would traverse flat areas which receive moderate to heavy grazing pressure; most of these flat plains are equivalent to Dorn's shortgrass prairie, previously described. The remainder of the corridor through prairie grassland runs through break areas which receive less intense grazing pressure; the break areas probably support a mixed prairie (Dorn 1977).

As Table 2-40 shows, ponderosa pine forest covers roughly 5 percent (8 right-of-way miles, 97.5 acres) of the proposed corridor. The affected ponderosa pine habitat is in southern Converse and northern Platte counties, between MP 13.7 and 73.6.

Dry stream bottom habitat includes areas which show little similarity to the adjacent grassland habitat. Continuous grassland habitat appears through most of the smaller, intermittent drainages which would be crossed; consequently, these areas were included as prairie grassland habitat. Stream bottoms with rough, broken banks appear less frequently and comprise less than 2 percent of the area affected by the proposed corridor.

TABLE 2-40

COUNTY SUMMARY OF VEGETATION TYPES AFFECTED BY THE PROPOSED PRODUCT PIPELINE CORRIDOR

Vegetative Habitat Type	County	Miles Traversed	Acres Disturbed
Prairie Grassland	Converse County, WY	26.6	322.5
	Platte County, WY	39.2	475.5
	Laramie County, WY	39.6	479.6
	Weld County, CO	4.4	53.4
	Route Total	109.8	1,331.0
Prairie Grassland - Breaks	Converse County, WY	0.3	3.6
	Platte County, WY	4.9	59.0
	Laramie County, WY	6.6	79.9
	Weld County, CO	0	0
	Route Total	11.8	142.5
Open Ponderosa Pine Forest - Breaks	Converse County, WY	0	0
	Platte County, WY	5.9	72.2
	Laramie County, WY	0	0
	Weld County, CO	0	0
	Route Total	5.9	72.2
Open Ponderosa Pine Forest	Converse County, WY	1.7	20.5
	Platte County, WY	0	0
	Laramie County, WY	0	0
	Weld County, CO	0	0
	Route Total	1.7	20.5
Ponderosa Pine Forest	Converse County, WY	0.4	4.8
	Platte County, WY	0	0
	Laramie County, WY	0	0
	Weld County, CO	0	0
	Route Total	0.4	4.8
Dry Stream Bottom	Converse County, WY	0.7	8.4
	Platte County, WY	1.3	15.6
	Laramie County, WY	1.0	12.0
	Weld County, CO	0	0
	Route Total	3.0	36.0

TABLE 2-40 Concluded

COUNTY SUMMARY OF VEGETATION HABITAT TYPES AFFECTED BY THE PROPOSED PRODUCT PIPELINE CORRIDOR

Vegetative Habitat Type	County	Miles Traversed	Acres Disturbed
Plains Cottonwood Type	Converse County, WY	0	0
	Platte County, WY	0.1	1.7
	Laramie County, WY	0	0
	Weld County, CO	0	0
	Route Total	0.1	1.7
Agricultural Lands	Converse County, WY	1.6	19.4
	Platte County, WY	23.1	279.9
	Laramie County, WY	4.5	54.5
	Weld County, CO	0	0
	Route Total	29.2	353.8
Urban and Built-up Lands	Converse County, WY	0.1	1.2
	Platte County, WY	0.3	3.6
	Laramie County, WY	0.4	4.8
	Weld County, CO	0	0
	Route Total	0.8	9.6
	PRODUCT PIPELINE TOTAL	162.7	1,972.1

Only the crossing of the south bank of the North Platte River in Platte County would affect riparian vegetation. The proposed route would disturb 1.7 acres of this habitat, 0.09 percent of the total acreage disturbed by the product pipeline corridor.

The remainder of the proposed corridor (18 percent) would traverse agricultural, and urban and built-up lands.

AUMs temporarily lost to the 100-foot-wide construction corridor for the pipeline are presented in Table 2-41. Most of the corridor lies in an area where grassland habitat supports 0.3 AUM/acre. A smaller portion of the route, through Converse County and northern Platte County (roughly from MP 0 to Cedar Top Butte and Sheep Mountain), is in the 10 to 14-inch Northern Plains precipitation zone; these grasslands support approximately 0.2 AUM/acre.

Terrestrial Wildlife

Wildlife species that could occur in the vicinity of the proposed product pipeline are listed in Appendix A (Tables A-7, A-8, and A-9). These lists were compiled from distribution data provided by Long (1965), Oakleaf et al. (1979), Baxter and Stone (1980), and Kingery and Graul (1978).

Big Game. The proposed product pipeline would traverse year-round habitat for mule deer, white-tailed deer, and antelope. According to the Wyoming Game and Fish Department (1980a), no critical big game habitat exists in the vicinity of the proposed pipeline corridor.

TABLE 2-41

ANIMAL UNIT MONTHS (AUMs) TEMPORARILY LOST DURING CONSTRUCTION OF THE PROPOSED PRODUCT PIPELINE CORRIDOR[a]

Vegetative Habitat Type	Acres Temporarily Disturbed on Range Sites Supporting 0.2 AUMs/Acre	AUMs Temporarily Lost on the 0.2 AUMs/Acre Range Sites (10-12 Inch Annual Precipitation zone)	Acres Temporarily Disturbed on Range Sites Supporting 0.3 AUMs/Acre (15-19 Inch Precipitation zone)	AUMs Temporarily Lost on the 0.3 AUMs/Acre Range Site	Total Acres Disturbed in Vegetative Habitat Type	Total AUMs Lost in Vegetative Habitat Type
Prairie Grassland	386.7	77.3	944.3	283.2	1,331.0	360.6
Prairie Grassland-Breaks	3.6	0.7	138.9	41.7	142.5	42.4
Open Ponderosa Pine Forest-Breaks	0	0	72.2	21.7	72.2	21.7
Open Ponderosa Pine Forest	20.5	4.1	0	0	20.5	4.1
Ponderosa Pine Forest	4.8	1.0	0	0	4.8	1.0
Dry Stream Bottom	2.4	N/A	33.6	N/A	36.0	N/A
Plains Cottonwood Type	0	N/A	1.7	N/A	1.7	N/A
Agricultural Lands	38.8	N/A	315.0	N/A	353.8	N/A
Urban and Built-up Lands	1.2	N/A	8.4	N/A	9.6	N/A
Total	458.0	83.1	1,514.1	346.7	1,972.1	429.8

[a]AUM estimates were taken from Soil Conservation Service range site inventories. These estimates change from 0.2 AUM/acre to 0.3 AUM/acre near Cedar Top Butte and Sheep Mountain (MP41) in Platte County, where the precipitation range changes from 10-14 inches to 15-19 inches annually.

Upland Game Birds. According to Oakleaf et al. (1979), the following upland game birds occur in the areas that would be traversed by the product pipeline: blue grouse, sage grouse, ring-necked pheasant, chukar, gray partridge, and turkey. According to April 1981 aerial surveys and the Wyoming Game and Fish Department (1980a), no sage grouse leks occur in the vicinity of the proposed corridor.

Waterfowl. Waterfowl that have been observed in the areas that would be traversed by the proposed product pipeline corridor are listed in Appendix A, Table A-8. Waterfowl habitat is, for the most part, limited to the permanent streams that would be crossed (see Table 2-42).

Raptors. Two golden eagle nests occur within 1 mile of the proposed corridor (Table 2-43). Several other raptor species occur in the vicinity of the proposed corridor (Appendix A, Table A-8), and many probably hunt in the area.

Aquatic Biology

The locations and flow characteristics of all the streams and rivers that would be crossed by the proposed product pipeline in Wyoming and Colorado are presented in Table 2-42. In Wyoming, the pipeline would cross 11 perennial and 103 intermittent or ephemeral streams; in Colorado, 5 intermittent or ephemeral streams would be crossed. Of this total, 4 would require individual Army Corps of Engineers' 404 permits. The remainder of the streams which would be traversed would be covered by a Nationwide 404 permit.

In Wyoming, one Class III river (the North Platte River) and seven Class IV streams (Broom, Patten, Deer, Bear, Little Bear, and Horse creeks and the Laramie River) would be crossed (U.S. Fish and Wildlife Service and Wyoming Game and Fish Department 1978); Class III streams are considered to maintain a substantial fishery resource, and

TABLE 2-42

LOCATIONS AND FLOW CHARACTERISTICS OF THE STREAMS AND RIVERS THAT WOULD BE CROSSED BY THE PROPOSED PRODUCT PIPELINE

Stream	MP	Flow	County
WYOMING			
UT Walker Creek	1.9	I	Converse
Walker Creek	2.0	I	Converse
UT Walker Creek	3.7	I	Converse
UT Walker Creek	3.9	I	Converse
UT Walker Creek	5.1	I	Converse
UT Walker Creek	5.3	I	Converse
UT Walker Creek	5.5	I	Converse
UT Walker Creek	5.9	I	Converse
UT South Fork Walker Creek	6.5	I	Converse
UT South Fork Walker Creek	9.5	I	Converse
UT South Fork Walker Creek	10.0	I	Converse
UT South Fork Walker Creek	10.9	I	Converse
UT Middle Fork Shawnee Creek	11.4	I	Converse
UT Middle Fork Shawnee Creek	12.2	I	Converse
UT Middle Fork Shawnee Creek	12.4	I	Converse
UT East Fork Shawnee Creek	14.8	I	Converse
UT East Fork Shawnee Creek	15.0	I	Converse
Shawnee Creek	16.0	I	Converse
Whackoff Creek	16.5	I	Converse
UT Whackoff Creek	16.6	I	Converse
UT East Fork Shawnee Creek	17.4	I	Converse
UT East Fork Shawnee Creek	17.6	I	Converse
UT East Fork Shawnee Creek	19.5	I	Converse
UT East Fork Shawnee Creek	21.5	I	Converse
Lost Creek	23.5	I	Converse
UT Lost Creek	24.5	I	Converse
UT Muddy Creek	27.8	I	Converse
UT Muddy Creek	28.0	I	Converse
Spanish Creek	32.0	I	Platte
UT Willow Creek	36.1	I	Platte
Willow Creek	36.3	I	Platte
UT Willow Creek	36.5	I	Platte
UT Willow Creek	36.6	I	Platte
UT Willow Creek	36.7	I	Platte
UT Willow Creek	37.1	I	Platte
UT Willow Creek	38.2	I	Platte
Unnamed Stream	42.1	I	Platte
Unnamed Stream	44.5	I	Platte
Broom Creek	45.5	P	Platte
UT Patten Creek	46.8	I	Platte
UT Patten Creek	47.1	I	Platte
Patten Creek	48.8	I	Platte
UT Patten Creek	48.9	I	Platte

TABLE 2-42 Continued

LOCATIONS AND FLOW CHARACTERISTICS OF THE STREAMS AND RIVERS THAT WOULD BE CROSSED BY THE PROPOSED PRODUCT PIPELINE

Stream	MP	Flow	County
WYOMING (continued)			
UT Patten Creek	49.0	I	Platte
UT Patten Creek	49.5	I	Platte
Sam Draw Creek	51.0	I	Platte
Unnamed Stream	53.0	I	Platte
North Platte River[1]	62.4[a]	P	Platte
UT North Platte River	63.0	I	Platte
UT North Platte River	63.2	I	Platte
UT Laramie River	65.1	I	Platte
UT Laramie River	66.1	I	Platte
Laramie River[1]	66.6[a]	P	Platte
UT Laramie River	67.1	I	Platte
UT Laramie River	68.1	I	Platte
UT Laramie River	70.1	I	Platte
UT Deer Creek	73.2	I	Platte
Deer Creek	75.1[a]	I	Platte
Unnamed Stream	81.0	I	Platte
Unnamed Stream	82.0	I	Platte
Unnamed Stream	82.5	I	Platte
Unnamed Stream	84.0	I	Platte
Unnamed Stream	84.5	I	Platte
Springs	86.0	P	Platte
UT Box Elder Creek	96.0	I	Platte
Bear Creek[1]	107.8[a]	P	Laramie
Little Bear Creek[1]	113.4[a]	P	Laramie
UT Little Bear Creek	115.1	I	Laramie
UT Little Bear Creek	115.5	I	Laramie
UT Little Bear Creek	116.0	I	Laramie
Unnamed Stream	117.2	I	Laramie
Unnamed Stream	117.4	I	Laramie
Unnamed Stream	117.6	I	Laramie
Carey Horse Creek Ditch No. 10	118.8[a]	P	Laramie
Horse Creek[1]	119.1[a]	P	Laramie
UT Horse Creek	120.5	I	Laramie
Unnamed Stream	122.0	I	Laramie
Unnamed Stream	122.2	I	Laramie
Unnamed Stream	122.3	I	Laramie
Unnamed Stream	123.8	I	Laramie
Unnamed Stream	124.0	I	Laramie
Unnamed Stream	125.0	I	Laramie
Unnamed Stream	125.2	I	Laramie
Unnamed Stream	126.2	I	Laramie
Unnamed Stream	129.0	I	Laramie
Unnamed Stream	130.1	I	Laramie
Unnamed Stream	130.7	I	Laramie

TABLE 2-42 Concluded

LOCATIONS AND FLOW CHARACTERISTICS OF THE STREAMS AND RIVERS THAT WOULD BE CROSSED BY THE PROPOSED PRODUCT PIPELINE

Stream	MP	Flow	County
WYOMING (continued)			
Unnamed Stream	131.0	I	Laramie
Unnamed Stream	131.2	I	Laramie
Unnamed Stream	131.3	I	Laramie
Unnamed Stream	131.7	I	Laramie
Unnamed Stream	131.8	I	Laramie
North Lodgepole Ditch[1]	131.9	P	Laramie
Lodgepole Creek[1]	133.0[a]	P	Laramie
UT Lodgepole Creek	133.1[a]	I	Laramie
UT Lodgepole Creek	133.2	I	Laramie
UT Ninemile Draw Creek	134.5	I	Laramie
Ninemile Draw Creek	136.0	I	Laramie
UT Ninemile Draw Creek	136.5	I	Laramie
Unnamed Stream	140.6	I	Laramie
Unnamed Stream	141.2	I	Laramie
Unnamed Stream	143.1	I	Laramie
Unnamed Stream	143.8	I	Laramie
UT Crow Creek	146.0	I	Laramie
UT Crow Creek	147.0	I	Laramie
UT Crow Creek	146.3	I	Laramie
Crow Creek[1]	147.6[a]	I	Laramie
Wyoming Hereford Ranch Ditch	148.0	P	Laramie
Unnamed Stream	151.8	I	Laramie
Porter Draw Creek	154.0	I	Laramie
UT Little Simpson Creek	155.5	I	Laramie
UT Little Simpson Creek	156.0	I	Laramie
Unnamed Stream	157.5	I	Laramie
Unnamed Stream	157.8	I	Laramie
COLORADO			
Unnamed Stream	159.0	I	Weld
Unnamed Stream	159.5	I	Weld
UT Owl Creek	161.3	I	Weld
UT Owl Creek	161.5	I	Weld
UT Owl Creek	162.0	I	Weld

[a]Mileposts for these streams have been read from aerial photographs of the pipeline routes; the others are from site-specific topographic maps.

I = Intermittent
P = Perennial
UT = Unnamed Tributary
MP = Approximate Milepost Marker
1 = Individual Section 404 Permit Required

TABLE 2-43

LOCATIONS OF KNOWN GOLDEN EAGLE NESTS AND ROOSTS WITHIN 5 MILES OF THE PROPOSED PRODUCT PIPELINE

Township, Range, Section (County, State)	Nest or Roost	Distance From Proposed Corridor
T. 66 N., R. 30 W., sec. 29 (Platte County, WY)	Nest	0.26 mile south of MP 39.1 on Cedar Top Butte
T. 66 N., R. 21 W., sec. 24-25 line (Platte County, WY)	Nest	Nest occurrence questionable[a]
T. 66 N., R. 21 W., sec. 21 (Platte County, WY)	Nest	2.0 miles west of MP 96 on Chugwater Flats
T. 66 N., R. 19 W., sec. 11 (Laramie County, WY)	Nest	0.15 mile east of MP 109[b]
T. 66 N., R. 19 W., sec. 29 (Laramie County, WY)	Nest	2.0 miles west of MP 112

Data from Wyoming Game and Fish Department (1980a) and Willie Fitzgerald (Bureau of Land Management, Casper, Wyoming, personal communication, January 9, 1981).

[a] According to Allan Jenkins (U.S. Fish and Wildlife Service, Denver, Colorado, personal communication, February 25, 1981), the Fish and Wildlife Service searched Box Elder Creek for this eyrie but found no evidence of a nest.

[b] Location from Allan Jenkins (U.S. Fish and Wildlife Service, Denver, Colorado, personal communication, February 25, 1981).

Class IV streams are believed to sustain only a limited fishery resource. All other Wyoming streams that would be crossed were unclassified by the U.S. Fish and Wildlife Service and Wyoming Game and Fish Department (1978) and were considered Class 5 streams by the Wyoming Game and Fish Department (1977a). The state of Wyoming considers Class 5 streams to be very low production waters which are generally incapable of sustaining a fishery (Wyoming Game and Fish Department 1977a). The five intermittent or ephemeral streams that would be crossed in Colorado are unclassified by the U.S. Fish and Wildlife Service and Colorado Division of Wildlife (1979) and it is presumed that they, like the unclassified Wyoming streams, are low-production waters.

Fishes collected from several of the drainages that would be crossed by the product pipeline are presented in Table 2-44 (Wyoming Game and Fish Department 1979). Of the species that occur in these drainages, the green sunfish, yellow perch, catfish, and trout are considered high-value game or food fishes. The green sunfish, however, often exhibits stunted growth in these eastern Wyoming drainages (Wesche and Johnson 1980).

Patten Creek would be traversed at MP 48.8. Patten Creek fisheries are limited; brook trout is the only inhabitant reported by the Wyoming Game and Fish Department (1979). Fishing intensity is average for this region, at 3 fisherman days per year per mile. The stream is managed under the basic yield concept, the objective of which is to provide fishermen the opportunity to harvest fish. Basic yield streams may or may not be stocked; if stocked, fry or fingerlings are used. Patten Creek is not stocked at present.

The North Platte River would be crossed at MP 62.4. Parts of the North Platte River sustain significant trout fisheries in this

TABLE 2-44

FISHES KNOWN TO OCCUR IN THE DRAINAGES THAT WOULD BE CROSSED BY THE PROPOSED PRODUCT PIPELINE

SPECIES	Patten Creek (MP 48.8)	North Platte River (MP 62.4)	Laramie River (MP 66.6)	UT Box Elder Creek (MP 96.0)	Bear Creek (MP 107.8)	Little Bear Creek (MP 113.4)	Horse Creek (MP 119.1)	Lodgepole Creek (MP 133.0)	Crow Creek (MP 147.6)
CLUPEIDAE (herring, shad)									
<u>Dorosoma cepedianum</u> (Gizzard shad)		X							
SALMONIDAE (trouts)									
<u>Salmo gairdneri</u> (Rainbow trout)		X					X		
<u>Salmo trutta</u> (Brown trout)		X	X				X		
<u>Salvelinus fontinalis</u> (Brook trout)	X				X	X	X	X	
ESOCIDAE (pikes)									
<u>Esox lucius</u> (Northern pike)		X							
CYPRINIDAE (minnows)						X		X	X
<u>Cyprinus carpio</u> (Carp)		X	X				X		
<u>Semotilus atromaculatus</u> (Creek chub)			X				X		
CATOSTOMIDAE (suckers)						X	X	X	X
<u>Carpiodes carpio</u> (River carpsucker)		X							
<u>Moxostoma macrolepidotum</u> (Nortnern redhorse)		X							
<u>Catostomus commersoni</u> (White sucker)		X	X						
<u>Catostomus catostomus</u> (Longnose sucker)		X	X						
ICTALURIDAE (catfishes)									
<u>Ictalurus punctatus</u> (Channel catfish)		X							
<u>Ictalurus melas</u> (Black bullhead)		X							
<u>Noturus flavus</u> (Stonecat)		X	X						
CENTRARCHIDAE (sunfishes)									
<u>Lepomis cyanellus</u> (Green sunfish)		X							
PERCIDAE (perches)									
<u>Stizostedion vitreum vitreum</u> (Walleye)		X							
<u>Perca flavescens</u> (Yellow perch)		X							

Source: Wyoming Game and Fish Department 1979.

region of Wyoming, with fishing intensity higher than average for streams of regional importance (Wyoming Game and Fish Department 1979). North Platte waters, however, are often turbid, and noxious wastes may occur (Wyoming Game and Fish Department 1979). The river is managed under the basic yield concept. Productivity is low and hatchery stocking is required to maintain fishery success (Wyoming Game and Fish Department 1979). Channel catfish fingerlings are presently being stocked. The river is not managed for trophy fish, unique species, or wild fish. Fishing pressure was reported as 98 fishermen days per year per mile.

The Laramie River would be traversed by the product pipeline at approximately MP 66.6. This low-production stream of local importance sustains a fishing pressure of 10 fisherman days per year per mile, which is higher than the statewide average (Wyoming Game and Fish Department 1979). The fishing waters cannot withstand heavy fishing pressure due to lack of cover, short growing season, and shallow waters. This river segment is managed under the basic yield concept; there is no stocking at the present time.

An unnamed tributary of Box Elder Creek would be traversed at MP 96.0. According to the Wyoming Game and Fish Department (1979), it is not known which species of fishes are indigenous to Box Elder Creek. The department, however, estimates a fishing pressure of 1 fisherman day per year per mile in this very low production stream. It is managed under the basic yield concept; there is no stocking because there is insufficient management data for this stream.

Bear Creek, a tributary of Horse Creek, would be traversed at approximately MP 107.8. Brook trout is the only species that is known to be present (Wyoming Game and Fish Department 1979). A fishing

pressure of 4 fishermen days per year per mile was reported, which is average for streams of local importance in Wyoming. The fishing waters cannot withstand heavy fishing pressure due to lack of cover, short growing season, and shallow waters. Bear Creek is managed under the basic yield concept; there is no stocking at the present time.

Little Bear Creek, a tributary of Bear Creek, would be crossed at MP 113.4. This low-production stream, which cannot withstand much fishing pressure, is characterized by a lack of cover, short growing season, and shallow waters. Of the 23 miles of stream habitat, only 18 miles have suitable fish habitat. An average fishing pressure of 2 fishermen days per year per mile was reported. It is managed under the basic yield concept, with no stocking at the present time.

Horse Creek would be traversed at MP 119.1. With a fishing pressure of 7 fishermen days per mile per year, Horse Creek has a fishing intensity that is higher than average for streams of local importance (Wyoming Game and Fish Department 1979). Horse Creek is a tributary of the North Platte River. The low-production fishing waters cannot withstand heavy fishing pressures; local fishing pressure exceeds the supply available from natural reproduction and stocking of fry. Horse Creek is managed under the "catchables" concept, the objective of which is to provide fishermen the opportunity to harvest fish; such streams are stocked with fish that have been raised to catchable size in a hatchery. Horse Creek is being stocked with rainbow trout over 8 inches in length.

A very low production stream, Lodgepole Creek, would be crossed at approximately MP 133.0. Only 10 miles of the total 23 miles of stream habitat is suitable for fisheries (Wyoming Game and Fish Department 1979). Brook trout, chubs, and suckers are known to be present. Lodgepole Creek is a tributary of the South Platte River.

Fishing pressure was reported as 5 fishermen days per year per mile. The stream is managed under the basic yield concept; there is no stocking at the present time.

The proposed pipeline would cross Crow Creek at MP 147.6. Chubs and suckers are the only fishes known to be present (Wyoming Game and Fish Department 1979). There is little possibility of maintaining minimum in-stream flows; therefore, Crow Creek does not sustain a fishery. Crow Creek flows into the South Platte River. Fishing pressure was estimated at 1 fisherman day per year per mile. Crow Creek is managed under the basic yield concept, with no stocking at the present time.

Other streams that would be traversed by the proposed product pipeline have not been surveyed by the Wyoming Game and Fish Department (1979). It is expected that these streams would contain a fish fauna similar to that reported in Table 2-44. Since most of these are intermittent streams, they would not sustain a permanent fishery. They probably are low-production streams with little or no fishing pressure (Wyoming Game and Fish Department 1979).

The distribution and abundance of aquatic invertebrates are not well documented for the affected area. Pennak (1966) reported that there is a large group of species, many microscopic, which are cosmopolitan in suitable habitats all over the world and would be well represented in the Wyoming area. These included many Protozoa, Turbellaria, Gastrotricha, Rotatoria, Nematoda, Tardigrada, Oligochaeta, Cladocera, Copepoda, Ostracoda, Hydracarina, a few Amphipoda and Odonata, and some Diptera. Some groups are known to be characteristic of or restricted to certain habitats or areas; these include Eubranchiopoda, Copepoda, Ostracoda, Hydracarina, Plecoptera, Ephemeroptera, Trichoptera, and Diptera. Groups whose zoogeographic distribution is

poorly known include Porifera, Coelenterata, Bryozoa, Hirudinea, and Isopoda. The decapod fauna is impoverished due to geographical barriers. Odonata and Hemiptera are well represented below 2,500 meters; few species have colonized the higher elevations.

Aquatic invertebrates have been surveyed at and near the proposed mine site and the intake on the North Platte River (WyCoalGas 1974; Wesche and Johnson 1980; Ecology Consultants, Inc. 1975b). It is expected that small streams that would be crossed by the proposed pipeline would possess faunas similar to those reported by Wesche and Johnson (1980) and WyCoalGas (1974). These species are listed in Tables 2-33 and 2-34. It is expected that the larger river crossings (North Platte and Laramie rivers) would have faunas similar to that reported at the intake site on the North Platte River (Table 2-13).

Threatened and Endangered Species

Species protected by state and federal endangered species legislation that could occur in the vicinity of the proposed pipeline corridor are listed in Table 2-45. No federal or state protected amphibians or fishes are expected to occur near the proposed corridor. One snake listed as rare by the Wyoming Game and Fish Department (1977b), the milk snake (Lampropeltis triangulum), could occur in the vicinity of the proposed pipeline corridor. Baxter and Stone (1980) reported Lampropeltis triangulum multistrata (pale milk snake) as the subspecies occurring in Wyoming. The pale milk snake occurs at lower elevations in eastern Wyoming counties and in the Big Horn Basin. Its habitat consists of scarp woodlands of the plains and foothills zone, typically at elevations below 6,000 feet (Baxter and Stone 1980).

Wherever the proposed pipeline corridor would approach or cross a prairie dog town, potential habitat for the black-footed ferret would

TABLE 2-45

ENDANGERED, THREATENED, RARE, AND STATUS REVIEW SPECIES THAT COULD OCCUR IN THE VICINITY OF THE PROPOSED PRODUCT PIPELINE

Species	Designation
Mammals	
Black-footed ferret[a] (Mustela nigripes)	
Birds	
Bald eagle[a] (Haliaeetus leucocephalus)	Endangered[b,c]
Peregrine falcon[a] (Falco peregrinus)	Endangered[b,c]
Amphibians and Reptiles	
None	
Fishes	
None	
Plants	
Persistent sepal yellowcress (Rorippa calycina)	Status Review[d]
Colorado butterfly-weed (Gaura neomexicana ssp. coloradensis)	Status Review[d]

[a]These species are protected under provisions of the Endangered Species Act of 1973. Wyoming does not have state-level Endangered species legislation. Colorado's state-level endangered species legislation does not protect habitat.

[b]Federal Register 45(99): 33768-33781.

[c]Listed as endangered in Colorado under provisions of the State Nongame and Endangered Species Act of 1973 (Colorado Division of Wildlife 1978).

[d]Although at the present time these plants receive no protection, they are under review by the U.S. Fish and Wildlife Service for possible inclusion on the federal list (Federal Register 45(242): 82481-82569).

be affected; basic habitat requirements of the black-footed ferret have been discussed in Section 2.A.1. Two dog towns would be traversed by the product pipeline at MP 67 and 148 (Table 2-24). Clark (1973) reported six ferret sightings in Converse, Platte, and Laramie counties between 1851 and 1973 (Table 2-46). The most recent sighting was in Platte County near Shawnee in 1948. Clark also estimated that 15,340 acres of potential ferret habitat (black-tailed prairie dog towns) existed in Converse, Platte, and Laramie counties in 1971.

There are no known bald eagle nests or winter roosts in counties that would be traversed by the pipeline. However, wintering bald eagles could be encountered along most of the corridor, especially at the North Platte and Laramie river crossings.

Similarly, peregrine falcon nesting habitat is lacking in the portions of Converse, Platte, and Laramie counties, Wyoming, and Weld County, Colorado, that would be traversed by the corridor (Wyoming Game and Fish Department 1980a). The biology of these species has been described in Section 2.A.1.

No federally listed or proposed threatened or endangered plant taxa occur in the vicinity of the proposed product pipeline corridor (Federal Register 45(242):82480-82569). Three taxa have been listed as special interest species by the U.S. Bureau of Land Management and/or the U.S. Fish and Wildlife Service, two of which could occur near the proposed corridor.

The status of the Laramie false sagebrush (Sphaeromeria simplex) is currently under review for possible listing as a federally endangered or threatened species by the U.S. Fish and Wildlife Service (Federal Register 45(242):82480-82569). Dorn (1977, 1980) reports

TABLE 2-46

BLACK-FOOTED FERRET SIGHTINGS REPORTED IN CONVERSE, PLATTE, AND LARAMIE COUNTIES, WYOMING, BETWEEN 1851 AND 1973

County	Date	Location
Converse	1917	Douglas
Platte	1933	Wheatland
Platte	1948	Near Shawnee
Laramie	1877	Cheyenne
Laramie	1877	Cheyenne
Laramie	?	Duck Creek

Source: Clark 1973.

S. simplex endemic to the "rocky limestone slopes in pockets of soil deposition" in Albany County, Wyoming, near Laramie. Only a single population of approximately 2,000 individuals is known (Dorn 1980). That population, which is associated with Phlox bryoides, occurs at an elevation of about 7,500 feet. According to Bob Lichvar (1981) of the Wyoming Nature Conservancy, the microhabitat necessary to support S. simplex is lacking near the proposed pipeline corridor.

Rorippa calycina (persistent sepal yellowcress) is currently under review for possible listing by the U.S. Fish and Wildlife Service as federally endangered or threatened (Federal Register 45(242):82480-82-569). Dorn (1980) lists the present Wyoming distribution as "Carbon County, Wyoming, from Seminoe Reservoir to Medicine Bow." Rorippa calycina is not presently a concern in Colorado (Ecology Consultants, Inc. 1978). Habitat for this species is sandy river or reservoir shorelines near the high-water mark (Dorn 1980). Dorn lists fluctuating water levels as a potential threat to R. calycina. Bob Lichvar (1981) has suggested that this species may have been transported east through the North Platte River system. Consequently, R. calycina could exist at the proposed product pipeline crossing of the North Platte River, downstream of Guernsey Reservoir.

Gaura neomexicana ssp. coloradensis (Colorado butterfly-weed) is currently under review by the U. S. Fish and Wildlife Service for potential listing as federally endangered or threatened (Federal Register 45(242):82480-82569). This subspecies is of special concern in Wyoming (Dorn 1980) and Colorado (Ecology Consultants, Inc. 1978). Dorn (1980) lists the present distribution as "Weld County,

Colorado, and Laramie County, Wyoming, near Cheyenne." Ecology Consultants, Inc. (1978), lists humic soils in wet areas and drainage bottoms at an elevation of 5,000 to 6,000 feet as habitat for G. n. ssp. coloradensis. Dorn (1980) adds that moist meadows typically at a transition between wet stream bottoms and dry uplands comprise typical habitat for this subspecies. Common associates are Helianthus nuttallii, Rudbeckia hirta, and Cirsium flodmanii. The potential for occurrence of the Colorado butterflyweed exists in any wet meadow habitat on the southern end of the proposed pipeline corridor (Lichvar 1981, Dorn 1980).

Chapter 3
ENVIRONMENTAL CONSEQUENCES

This chapter presents both qualitative and quantitative information regarding biological impacts which could reasonably be expected to result from project implementation. Impacts which would be anticipated to be specific or unique to a particular project component are discussed under the appropriate project component heading. Impacts common to more than one project component are discussed in Section 3.A (Generic Impact Discussion) and are not discussed further under the individual component headings. Furthermore, only impacts anticipated as a result of routine construction, operation, maintenance, and abandonment procedures are addressed in Sections 3.A through 3.F. Impacts potentially resulting from non-routine operations (e.g., pipeline spills, ash spills, coal spills) are discussed only in Section 3.G and are not considered under individual project component headings. Alternatives to the proposed action are assessed in Chapter 4.

3.A GENERIC IMPACT DISCUSSION

3.A.1 VEGETATION

Construction

The most severe impacts to vegetation will occur during the construction phase of the proposed project. Depending on the vegetation type affected, several generic impacts may be apparent for some time after construction has been completed.

The loss of protective vegetative cover in cleared areas will result in disturbance to the root systems and the soil humus layer, two factors important to soil stabilization and moisture retention.

This, in turn, could accelerate erosion, especially on slopes or other naturally unstable areas.

Vegetative impacts will be apparent until the affected community or association has returned to its preconstruction state. In agricultural areas this will probably occur with the planting of the following season's crop, except at permanent facilities. In ponderosa pine and plains cottonwood areas, the disturbance will be long term, since revegetation in such areas could take as long as 20 to 50 years. All linear corridors would be allowed to revegetate to preconstruction conditions.

In prairie grassland areas, substantial recovery should be fairly rapid, since grasses tend to reseed and grow quickly even in this semiarid region. However, scattered small shrubs will be slower to reestablish and mature. Consequently, these disturbed areas will be distinguishable from the surrounding grassland until shrub species attain their preconstruction size and distribution.

In areas where big sagebrush and other shrubs are codominants with the grasses, it will take as long a period of time as the more grassy areas, or possibly longer, to fully recover to a preconstruction condition due to the slower growth of these particular shrub species.

The impacts on riparian associations will be greatest in areas with larger and slower-growing trees (cottonwood, willow, etc.). Recovery of these tree species to a mature state will require a period of years after construction activities end. Tree species would be allowed to reestablish over all pipeline corridors.

The potential exists that linear project components could affect wetland areas, although April and May aerial surveys failed to locate wetlands in the vicinity of project components. The most significant impact which typically results from construction is wetland habitat loss, primarily as a result of draining, filling, leveeing, ditching, and other construction activities. In addition, construction activities sometimes result in the introduction of large quantities of suspended solids to the aquatic environment, which results in increased turbidity and widespread siltation of wetland bottoms. Siltation and increased turbidity could result in a reduction of plant diversity and density in the wetland ecosystem. Because wetland habitat and associated vegetation are sparse in eastern Wyoming and northeastern Colorado, destruction of wetland habitat is considered a significant impact; however, the effects in all cases would be localized. As long as siltation is restricted, the impact should be minimal and short term due to the anticipated rapid establishment of indigenous sedges, rushes, cattails, and other wetland plant species.

Acreages of natural vegetation types that would be permanently or temporarily disturbed by all project components are summarized in Table 3-1. The vast majority of the affected vegetation would be prairie grassland (approximately 9,900 acres or 95 percent of the total affected vegetation).

While vegetation disturbances could be locally significant during construction, actual impacts on vegetation would be generally insignificant and, for the most part, short term with implementation of a successful reclamation program. Successful revegetation and reestablishment of grazing would be expected to occur in most areas along the proposed linear corridors with implementation of an erosion control and revegetation plan. From one to five years would be required for a

Table 3-1

SUMMARY OF ACRES TEMPORARILY AND PERMANENTLY DISTURBED FOR ALL PROJECT COMPONENTS, BY NATURAL VEGETATION TYPE[a]

Vegetation Type	Total Acres Temporarily Disturbed	Total Acres Permanently Disturbed
Prairie Grassland	8,300	1,600
Plains Cottonwood Type	2	8
Ponderosa Pine	190	0
Dry Stream Bottom	50	198
Playa	79	0
Total	8,621	1,806

[a]Permanently disturbed areas would be affected for at least the life of the project (35 years); whereas temporarily disturbed areas would be allowed to revegetate after construction or mining activities are terminated.

stand of vegetation to become established. Longer periods of time may be required when unfavorable weather conditions occur.

Revegetation success would vary; it would be least successful in areas with steep slopes susceptible to erosion, in areas with shallow and unfavorable soils, and in the more arid portions of the project area. Revegetated areas with lower vegetation densities would be susceptible to accelerated soil erosion and invasion of undesirable plants. These areas would require a longer period of time to revegetate, and controlled grazing to protect vegetation would be necessary. A few small areas where adequate vegetation cannot be established and maintained would require critical area treatment with continuing erosion control and revegetation measures.

WyCoalGas is committed to the use of waterbars and other erosion control techniques. Consequently, impacts resulting from potential erosion should be minimal and localized.

After construction is completed, less desirable plant species (i.e., annuals and/or noxious or poisonous weeds) could invade the disturbed area. Subsequently, a loss of forage value in the disturbed area could result. Although it is impossible to predict precisely where disturbed areas would be most susceptible to invasion of less desirable taxa, a successful reclamation plan would allow for only localized impact. Invasion of disturbed areas by noxious and/or poisonous weeds is considered a locally significant impact.

Construction-related dust would occur in areas where surface disturbances would be necessary. Dust raised during construction would be expected to settle on nearby vegetation. Since construction activity would occur in any given area for only a short period of time, dust-related impacts are considered short term. Rainfall would

be expected to remove dust that settled on vegetation in the construction area. Dust-related impacts are expected to be localized and insignificant at all project components.

Operation, Maintenance, and Abandonment

Linear components (i.e., pipelines) would not require vegetation control maintenance, and woody plants would be allowed to reestablish directly over the corridor. Herbicide use would follow state and federal guidelines; consequently, impacts resulting from use of these substances are expected to be negligible.

Normal traffic patterns on roads would raise some dust that would settle on plants near the access and haul roads. Such impacts are localized and biologically insignificant. Similarly, windblown ash and fugitive coal dust could accumulate on vegetation near the plant site and mine. The impacts to vegetation would be localized and insignificant.

3.A.2 TERRESTRIAL WILDLIFE

Construction

Impacts to terrestrial wildlife which could result from construction of components of the proposed project are discussed throughout this report in two general categories: (1) direct and indirect loss of wildlife habitat; (2) the actual loss of wildlife populations resulting from direct destruction or the inability of displaced individuals to survive in adjacent undisturbed habitat.

The major impacts to wildlife from construction of any project component will be the loss of habitat and associated animal populations caused by land clearing. Construction noise and human activity are less severe impacts which may alter normal activity patterns of

wildlife in areas adjacent to the proposed construction sites. However, the magnitude and duration of construction impacts will vary with the animals' size, mobility, migration patterns, life span, breeding habits, and breeding season. Population size, distribution, home range, territoriality, and other ecological factors may also affect the nature and magnitude of impacts on animals.

Mobility, as any other of the above factors, can be used to illustrate the diversity of impacts expected to be incurred by various species. Invertebrates and small vertebrates within the construction area will be directly affected by construction activity because they are unable to move to another area. On the other hand, populations of these same species in the general region, but beyond the area of direct disturbance, should not suffer. Construction should have little direct effect on populations of antelope or deer, since the construction area involves a small portion of the total range over which these species forage.

Noise from machinery, people, and blasting, as well as the constant activity associated with construction, may disturb animals in the immediate area. Larger, more mobile animals (deer and antelope) will probably leave the area at the first indication of human activity. Small birds, mammals, and invertebrates which have home ranges within the "zone of influence" of the proposed construction activity will be severely disturbed by the noise and activity. However, regional population levels will be only negligibly affected.

Poaching by construction workers may result in higher mortality of deer and antelope during construction. However, this impact would be short term and most poaching should decrease as the construction labor force is reduced. A higher incidence of road kills could also

affect the mule deer and antelope populations. Other species, especially small game and medium-sized mammals, would also be affected. Road kills will be most evident on heavily traveled construction and access roads, especially if roads are used at night.

Construction-related impacts to small mammals, passerine birds, and amphibians and reptiles are similar for all project components and are discussed generically below. Predicted impacts to big game, waterfowl, upland game birds, and raptors are more specific and are discussed by component in the remainder of this chapter.

Carnivores, Small Game, and Furbearers. Large carnivores (coyote) and small carnivores (skunk, weasel, and fox) generally have large home ranges over which they regularly move. Such areas may include several habitat types, particularly the riparian communities. The loss of a small portion of the home range within a linear right-of-way (i.e., pipelines, access roads, transmission lines, etc.) will probably have a minimal impact. On the other hand, certain species such as rabbits tend to have small ranges and are generally restricted to the region immediately surrounding their burrows. Where a linear right-of-way passes through these territories, the impact will be severe, but temporary. Rabbits will return to the right-of-way soon after construction ceases. Populations of rabbits, coyotes; and other abundant species should recover quickly to preconstruction levels in linear corridors and other sites of temporary disturbance.

At sites which will suffer more permanent and/or extensive surface disturbances (i.e., Rochelle Mine, plant site, railroad corridor), impacts to carnivores, small game, and furbearers will be more severe. The entirety or majority of the home range of small and large carnivores may be lost for the life of the project. These predators would be displaced into surrounding habitat, and possibly some would

not successfully reestablish new home ranges. The impacts to these individuals would be severe, although the effect on regional populations is expected to be insignificant. The entire population of small game and other species with small home ranges would be eliminated at permanent sites. However, the losses, in terms of regional populations, are expected to be localized and insignificant.

<u>Nongame Mammals</u>. Localized elimination of individual small mammals such as mice, ground squirrels, voles, shrews, and/or their habitats would result at all construction sites because these animals have small home ranges and tend to retreat to their burrows when disturbed or threatened. However, the impact will be short term because of the high reproductive potential and short generation time of most of these species. Hence, a linear corridor is likely to be rapidly reinvaded. Changes in species composition may occur until preconstruction conditions are achieved due to the change in habitat after reclamation. At permanent facilities, losses of small mammals would be locally severe but would represent regionally insignificant impacts.

<u>Passerine Birds</u>. The loss of habitat along linear corridors should have an insignificant and temporary adverse impact on most songbirds foraging in proposed rights-of-way. The area involved will probably constitute only a small proportion of the total area in which they normally forage. When the vegetation is removed, some small birds that defend their territories will leave but will probably be unable to establish territories elsewhere because of the established presence of other individuals. The chances of reproductive success for displaced birds would be limited. There may be a locally severe impact on birds living or breeding at permanent facilities or nearby. However, the effect is expected to be regionally insignificant.

Nesting sites of birds, which could occur within the proposed rights-of-way and at permanent facilities, would be destroyed. Consequently, some eggs or young birds may be lost or abandoned. This impact is considered to be localized, short term, and insignificant in terms of regional populations.

Reptiles and Amphibians. Most reptiles and amphibians are mobile and many will escape from the path of construction equipment. Others will be killed or injured, particularly species which may have retreated to dens. The loss of these individuals will have an immediate effect on local populations but will have insignificant impacts on regional populations. Where all shrub growth is removed from the grassland habitat, snakes may not readily reoccupy the area because of the lack of shelter from the sun.

Operation, Maintenance, and Abandonment

Noise, dust, and general increased human presence could affect wildlife in the vicinity of project components, although some acclimation is expected for less sensitive species. Generic impacts would be similar to those described above for construction. Significant operation, maintenance, and abandonment-related impacts are not anticipated to terrestrial wildlife from most project components.

3.A.3 AQUATIC BIOLOGY

Construction

Construction of the various components of the proposed project would affect aquatic biota in two general ways: direct disturbance, and/or indirect disturbance or elimination of habitat. Direct disturbances which could reasonably be expected to occur as a result of project implementation include construction of access roads, transmission lines, and pipeline, in addition to hydrostatic test water

discharge. Indirect construction disturbance which could be anticipated may include petrochemical spills, non-point source pollutants, and sedimentation/siltation. These potential physical habitat disturbances which could result in biological impacts will be addressed generically in this subsection.

The potential exists at any construction site for spills of fuels, lubricants, and other petrochemicals. Construction sites for all proposed project components would be confined to areas of Wyoming and Colorado which are considered semiarid. Because of low-precipitation, only 23 of the 221 potentially affected rivers and streams are perennial. Spills of petrochemicals into flowing water habitats, therefore, would occur only to these perennial streams and to others only during periods of high rainfall (and runoff).

Spills of petrochemicals directly into flowing waters would be unlikely, however, since equipment maintenance and refueling would generally be conducted outside stream channels. Nevertheless, if such a spill occurred, a fish and invertebrate kill could result (U.S. Environmental Protection Agency 1976a; Thurston et al. 1979). The small volume of petrochemicals spilled (anticipated to be less than 50 gallons) and the instantaneous nature of such spills would be expected to result in localized (from the spill location to the downstream area where pollutants would be diluted to nontoxic concentrations) and short-term impacts. Community recovery would be anticipated within 5 years.

A more likely petrochemical spill scenario would involve the spilling of materials on dry soils. The volatile component of the materials, the most toxic, would be expected to evaporate rapidly. The remaining petrochemical components would be washed into stream channels during periods of heavy rainfall and runoff. By the time

discharge. Indirect construction disturbance which could be anticipated may include petrochemical spills, non-point source pollutants, and sedimentation/siltation. These potential physical habitat disturbances which could result in biological impacts will be addressed generically in this subsection.

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Spills of petrochemicals directly into flowing waters would be unlikely, however, since equipment maintenance and refueling would generally be conducted outside stream channels. Nevertheless, if such a spill occurred, a fish and invertebrate kill could result (U.S. Environmental Protection Agency 1976a; Emerson et al. 1979). The small volume of petrochemicals spilled (anticipated to be less than 50 gallons) and the instantaneous nature of such spills would be expected to result in localized (from the spill location to the downstream area where pollutants would be diluted to nontoxic concentrations) and short-term impacts. Community recovery would be anticipated within 2 years.

A more likely petrochemical spill scenario would involve the spilling of materials on dry soils. The volatile component of the materials, the most toxic, could be expected to evaporate rapidly. The remaining petrochemical compounds would be washed into stream channels during periods of heavy rainfall and runoff. By the time

these pollutants were leached from the soils and reached flowing water, their concentration would be anticipated to be sufficiently diluted to preclude the possibility of significant impacts to aquatic biota.

Non-point source pollutants include any contaminants (chemical or physical) which enter watercourses as a result of wind and/or rainfall conditions and cannot be identified as originating from any particular point source or sources. Like petrochemical spill contaminants, non-point source pollutants would be expected to enter both perennial and intermittent streams primarily as a component of rainfall runoff. The large volumes of water which would be anticipated to wash such pollutants into watercourses would also be expected to dilute them to non-toxic levels.

The anticipated physical effects of project component construction through, or adjacent to, potentially affected streams and rivers include stream siltation, flow regime, and habitat alteration (Darnell et al. 1976). The various biological impacts anticipated from these physical disturbances are expected to be similar for the fish and invertebrate faunas in each of the potentially affected water bodies. The precise extent or severity of the anticipated impacts would, of course, be expected to vary depending on specific construction techniques (e.g., bedrock blasting vs. trench and fill), physical stream characteristics (e.g., perennial vs. temporary), and biological characteristics (e.g., low density vs. high density faunas). Various assumptions regarding faunal density and productivity will be made. Impact assessment will rely on both these assumptions and the anticipated biological similarities throughout the potentially affected region.

Flow regime alteration is a construction effect which would not be expected to significantly affect aquatic biological communities, since disturbances within streams would be limited to such short time periods and streamflow (if present) would be maintained. Depending on river depth, width, and substrate, it is anticipated that river crossing construction would last from only a few hours to a few days.

The two physical construction effects which would be expected to precipitate detectable biological impacts are stream siltation/turbidity and habitat disturbance (temporary benthic substrate removal and bedrock blasting, in particular). All references to siltation/turbidity in this document refer to inorganic suspended materials, unless otherwise noted.

Stream crossing construction activities increase sedimentation and turbidity as a result of disturbance or removal of ground cover, heavy equipment traffic, and dredging in the stream channel. Cordone and Kelley (1961) and Stern and Stickle (1978) have completed extensive reviews of the literature regarding the biological effects of increased sedimentation and turbidity. It has been found that an increase in sedimentation can affect productivity throughout all trophic levels (Karr and Schlosser 1978; Stern and Stickle 1978; Peters 1967; Cordone and Kelley 1961; Gangmark and Bakkala 1960; and many others).

Although sustained periods of exposure to high suspended solids under laboratory conditions have been shown to cause adult and juvenile fish mortality (Herbert and Merkens 1961; Herbert and Richards 1963; and several studies reported in Stern and Stickle 1978), increases in ventilation (Horkel and Pearson 1966), physical damage to gills and other exposed tissues (Herbert and Merkens 1961; Ellis 1944 in Cordone and Kelley 1961), plus other behavioral effects, it has been shown that under natural conditions (Peters 1967; Herbert

et al. 1961; Burnside 1967) fish do not remain in areas of high turbidity. Further, elevated turbidity levels would be anticipated to last for only a few hours after the completion of construction.

These data suggest that the likely response of affected adult and juvenile fishes to increased turbidity would be temporary emigration from the affected area, a response that has been documented in the literature (Gammon 1970). These fishes would be expected to return to the construction areas within a few hours after turbidity levels return to normal. Therefore, it is anticipated that these impacts would be localized, short term, and insignificant. Since bank stabilization procedures would be used on pipeline rights-of-way, no long-term, erosion-related impacts would be anticipated.

The most notable fisheries impact associated with construction-induced turbidity would be a potential reduction in reproductive success. When fine sediment settles on coarse, unconsolidated substrates, the permeability of those substrates is decreased. When eggs are laid in affected areas, water may not flow freely over the eggs, which can result in a decrease in hatching success (Meehan and Swanston 1977; Auld and Schubel 1978). Auld and Schubel (1978) found that varying amounts of suspended sediments affected the hatching success of species of fish differently. Less than 1,000 mg/l did not affect the hatching success of yellow perch, blueback herring, alewife or American shad eggs, but 1,000 mg/l significantly reduced the hatching success of white perch and striped bass.

It is also believed that sediment affects the flow of water through gravel, preventing the removal of metabolic waste and entrance of oxygen (Cooper 1965; Sheridan and McNeil 1968; Meehan and Swanston 1977; and others). Shelton and Pollock (1966) found that if 15 to 30 percent of the interstices in gravel were filled with sediment, the

mortality of salmon eggs reached 85 percent. The sediment may act as a physical barrier to the fry, even if they do hatch successfully. Sedimentation can also disrupt reproduction by covering spawning grounds (Karr and Schlosser 1978), making them unavailable.

At those stream and river crossing locations where construction would coincide with fish migration periods, there is a possibility that instream activity would interfere with migration. Such interference has been reported in the literature (U.S. Environmental Protection Agency 1976), and the severity of the impact would depend on the spawning behavior of the species involved, the suspended solids increase anticipated, and the delineation of the downstream area to be affected.

In the smaller streams and rivers where instream construction would be completed in a few days or less, it is likely that migration would be temporarily suspended. Since most fishes migrate over a period of several days or weeks (Geen et al. 1966), migration would be expected to resume shortly after the completion of construction and settling of suspended materials.

In wide rivers where construction would last for several days and would precisely coincide with initial migration periods, spawning could be limited to unaffected downstream areas. This, however, would be an unlikely impact, since construction activity would be confined to a relatively small area along the pipeline crossing transect. It is likely that migrating fishes would use unaffected transect areas as migration corridors and would avoid active construction areas along the transect.

In summary, it is anticipated that there would be no significant impact to indigenous fish populations when river crossing construction

schedules do not coincide with critical fish migration or spawning activity. If, however, construction coincided with spawning activity, it would be likely that egg and larval mortality would be limited to the relatively small affected area (less than 1,000 feet downstream) (Woodward-Clyde Consultants 1980) and should be considered a localized, short-term impact with no detectable effect on population levels.

The primary impacts of stream siltation on aquatic invertebrates could be gill membrane abrasion, smothering, and loss of acceptable substrate habitat as a result of substrate in-filling. Casey (1959, as reported in Cordone and Kelley 1961) found that siltation for about 1/4 mile downstream from a dredging operation eliminated macroinvertebrates. There was a 50 percent reduction in numerical abundance 1 mile below the dredge site. Not only do macroinvertebrate populations decrease when sedimentation increases (Tebo 1955), but low-level sedimentation can alter species composition (Conlan and Ellis 1979; Rosenberg and Wiens 1978).

Rosenberg and Wiens (1978) noticed that sediment additions resulted in different drift rates for various invertebrates. White and Gammon (1977) reported that increases in suspended solids resulted in increased drift rates to more than double the normal rate. Since an increase in sedimentation results in a decrease in habitat diversity by filling in the substrate interstices, macroinvertebrate standing crop has been found to decrease (Williams and Mundie 1978; Allan 1975; Barber and Kevern 1973).

Mollusks, in addition to insects, may also be adversely affected by stream siltation. Ellis (1936) reported a general increase in mortality of mussels affected by silt, and many species of snails and mussels specifically avoid silt-substrate areas (Pennak 1978).

Regardless of the construction schedule, it is anticipated that these invertebrate impacts would be localized, short term, and significant, although full recovery would be expected within six months of construction completion. Rainstorm activity would be anticipated to scour the silt deposits from the natural substrates and thus make the substrates available for macroinvertebrate recolonization, as reported by Gore and Johnson (1979). There are anticipated to be no secondary impacts on local fishes, since they would either feed in unaffected areas or they would feed on available invertebrates in the affected areas.

The number of streams or rivers which would require construction blasting, as a result of a bedrock river bottom, is unknown at the present time. The likely impact would be the killing of aquatic biota in close proximity (distance unknown) to the blasting site. This impact would be considered short term and locally significant, with fish and invertebrate recovery anticipated within a few months of the completion of construction.

A more routine river crossing construction technique would be the "trench and fill" method. Assuming that there would be a 100-foot right-of-way at each crossing location, there would be a temporary loss of 111 square yards of benthic substrate for each 10 feet of river crossed.

Unless construction coincides with critical spawning periods, no significant impacts on adult and juvenile fishes would be anticipated. If construction coincides with spawning activity and eggs/larvae are present in the right-of-way substrate, they would be killed as a result of being discarded with the dredge spoil. This impact would be considered localized, short term, and significant, but it is not likely that population density would be detectably affected.

Regardless of the construction schedule, it is anticipated that a large number of macroinvertebrates would be killed as a result of dredging in perennial streams. Data summarized from Neves (1979), Bane and Lind (1978), and Ragland (1974) suggest that "typical" freshwater benthic invertebrate dry weight estimates range from 0.02 to 0.60 oz/yd^2 when appropriately converted. For assessment purposes a mean dry weight biomass of 0.50 oz/yd^2 has been assumed for all potentially affected macroinvertebrate populations. For each 10 ft (111 yd^2) of river crossed, the dry weight of eliminated benthic invertebrates would equal approximately 3.5 pounds. Table 3-2 summarizes the projected invertebrate biomass loss as a result of construction. This impact would be considered localized, short term, and significant, and macroinvertebrate recolonization of the right-of-way would be anticipated within a few months of the completion of construction (Gore and Johnson 1979), provided that adequate habitat is available for recolonization.

The anticipated secondary impacts of invertebrate removal on fishes which rely on them as a food source are also summarized in Table 3-2. This summary assumes that a fish would be approximately 15 percent efficient in converting its food to flesh (Russell-Hunter 1970). It should be noted that a 15 percent estimate is liberal. These data indicate that approximately 0.50 pound (dry weight) of fish flesh would be lost for every 10 feet of river crossed. This secondary impact on local fishes would be localized, short term, and of limited biological significance, since these fishes would be expected to simply move a short distance upstream or downstream in order to feed.

Construction of access/haul roads for all project components (except the railroad maintenance road) would directly affect only four intermittent streams in the project area. The railway maintenance

Regardless of the construction schedule, it is anticipated that a large number of macroinvertebrates would be killed as a result of dredging in perennial streams. Data summarized from Moses (1979), Gene and Lind (1978), and Ragland (1974) suggest that "typical" freshwater benthic invertebrate dry weight estimates range from 0.02 to 0.60 oz/m^2 when appropriately converted. For assessment purposes a mean dry weight biomass of 0.50 oz/yd^2 has been assumed for all potentially affected macroinvertebrate populations. For each 10 ft (111 yd^2) of river crossed, the dry weight of eliminated benthic invertebrates would equal approximately 3.5 pounds. Table 3-2 summarizes the projected invertebrate biomass lost as a result of construction. This impact would be considered localized, short term, and significant, and macroinvertebrate recolonization of the right-of-way would be anticipated within a few months of the completion of construction (Gore and Johnson 1979), provided that adequate habitat is available for recolonization.

The anticipated secondary impacts of invertebrate removal on fishes which rely on them as a food source are also summarized in Table 3-2. This summary assumes that a fish would be approximately 15 percent efficient in converting its food to flesh (Russel-Hunter 1970). It should be noted that a 15 percent estimate is liberal. These data indicate that approximately 0.53 pound (dry weight) of fish flesh would be lost for every 10 feet of river crossed. This secondary impact on local fishes would be localized, short term, and of limited biological significance, since these fishes would be expected to simply move a short distance upstream or downstream in order to feed.

Construction of access/haul roads for all project components (except the railroad maintenance road) would directly affect only four intermittent streams in the project area. The railway maintenance

Table 3-2
ESTIMATES OF MACROINVERTEBRATE AND EQUIVALENT FISH FLESH BIOMASS WHICH MAY BE LOST AS A RESULT OF RIVER CROSSING CONSTRUCTION

River Width (feet)	Macroinvertebrate Biomass (lbs, dry weight)	Fish Biomass (lbs, dry weight)
10	3.5	0.5
20	7.0	1.0
30	10.5	1.5
40	14.0	2.0
50	17.5	2.5
100	35.0	5.0
200	70.0	10.0
500	175.0	25.0
1,000	350.0	50.0
2,000	700.0	100.0
5,000	1,750.0	250.0

Note: See text for discussion of assumptions

road would be located in the railroad right-of-way and its potential construction impacts are considered in Section 3.D in conjunction with railroad right-of-way construction impacts. A general summary of road construction impacts, however, is presented here.

Streams potentially crossed by access/haul roads are all temporally or spatially intermittent and lack permanent biological communities. This lack of a permanent fauna suggests that construction through streams, including placement of structure (e.g., culverts) in the streams, would be expected to have short-term, localized, insignificant biological impacts even if construction were to coincide with flowing water periods. Affected biota would be expected to repopulate within one year of construction.

Twenty-six intermittent or ephemeral streams would be crossed by the various proposed transmission line routes. Impacts on aquatic biota from construction of transmission lines would be concentrated in equipment crossing areas. Utility poles are rarely placed in watercourses, and then only when the area is too wide to be spanned without middle support. Such cases do not exist in the project area.

If transmission line construction coincided with dry streambed periods (generally late summer through early winter), then no significant impact to aquatic biota would be anticipated. If construction occurred during flowing water periods, however, the location of the roadway (temporary or permanent) would be the factor determining the magnitude of anticipated impacts. If vehicles were to move through a stream channel, aquatic vascular plants, if present, would be broken or crushed in relation to the number of separate paths vehicles take. If one pathway was used repeatedly, aquatic vegetation would probably be eliminated in the pathway, but would be relatively unaffected outside the path.

Since most aquatic invertebrates are relatively immobile, ones in the path of vehicles would be crushed by the wheels. The number of individuals lost in this manner would be proportional to the number of vehicle crossings. Fish are more mobile and would largely be expected to evade vehicles. If spawning occurred in the area chosen as a pathway, however, eggs or larvae would probably be lost.

Unless wheel ruts were sufficient to alter drainage patterns, the effect on such wetland biota would be short term, probably less than one year. Recolonization of lost vegetation from unaffected areas and introduction of new generations of invertebrates from survivors and other adults would likely occur by the spring and summer following construction.

The discharge of untreated hydrostatic test water after its use in water and product pipelines may increase stream turbidity, decrease dissolved oxygen, and increase iron, oil, and grease concentrations in receiving waters. In addition, the physical result of a large-volume instantaneous discharge in a small perennial stream or flowing intermittent stream would be scouring of the stream bottom and banks, which could displace affected fishes and invertebrates to downstream locations or, in severe cases, wash them out of the stream channel. The biological impacts associated with increased turbidity are described above.

The effects of iron concentration on freshwater aquatic life have been summarized and a water quality criterion of 1.0 mg/l has been established for the protection of freshwater biota (U.S. Environmental Protection Agency 1976a). Untreated hydrostatic test water may have concentrations higher than that reported as acceptable by the U.S. Environmental Protection Agency (1976a). Various lethal and/or sublethal impacts on affected biota in streams where stream volume would

not be sufficient to dilute the concentration to 1.0 mg/l or less would be expected.

While detailed criteria for concentrations of oil and grease can only be established for specific water bodies, species, and oil or grease types, it can be generally stated that even an oily sheen on the water surface may be evidence of potentially lethal impacts on affected biota (U.S. Environmental Protection Agency 1976a).

Decreased dissolved oxygen concentrations in receiving waters would stress affected biota and could kill some sensitive species if concentrations of oxygen were reduced to 5.0 mg/l or less (U.S. Environmental Protection Agency 1976a). The cumulative impact of these biologcial effects in low-volume streams or rivers could be a localized "kill" affecting most trophic levels. Recovery of the affected stream or river would be expected within two years (if oil and/or grease do not accumulate in the stream's sediments) as a result of repopulation from unaffected contiguous streams.

No significant aquatic biological impacts would be anticipated to be associated with sanitary waste disposal facilities, since all state and federal regulations would be met.

Operation, Maintenance, and Abandonment

For project components where human activity would be maintained at a high level during the life of the project (e.g., coal gasification plant site, mine), it is anticipated that small-volume petrochemical spills, non-point source pollution, and stream siltation would occur. Low rainfall in conjunction with the dominance of intermittent and ephemeral streams in the project area suggest that the biological impacts anticipated from such disturbances would be short term, localized, periodic (generally coinciding with rainfall runoff),

and biologically insignificant. A more thorough discussion of these impacts is presented above.

It is anticipated that herbicides will be used as a routine maintenance procedure for many of the aboveground structures. The aquatic biological effects of herbicides have not been extensively studied but, in general, herbicides are considered to be less toxic to aquatic biota than pesticides (Bushnell 1974). Nevertheless, toxicity varies depending on in-stream concentration; type of herbicide; water temperature, hardness, and pH; season; affected species; application proximity to river or stream; soil porosity; and other factors. Effects of the toxicity of herbicides to fishes have been reported by Crosby and Tucker (1966), Holden (1972), and Pravda (1973). Kenk (1974) and Bushnell (1974) have reviewed data regarding herbicide effects on aquatic invertebrates and, like the fisheries investigations, have indicated variable results. These authors and others (Boyle 1980; Ramsay and Fry 1976; Harp and Campbell 1964; Brooker and Edwards 1974; Watson 1977) have reported: (1) both increases and decreases in aquatic productivity throughout trophic levels, (2) lethal and sublethal effects on fishes, (3) the capability of floods to scour herbicides out of river channels and sediments, and (4) the bioaccumulation potential of various types of herbicides. These data indicate that the precise extent and severity of aquatic biological impacts depend on numerous variables. Nevertheless, it seems reasonable to suggest that impacts could be minimized by the application of state and federally approved biochemicals by site-specific ground techniques.

Aquatic biological impacts associated with the "operation" of culverts (or other streamflow maintenance structures) will be discussed generically here, since it is unknown precisely where and for which components they would be constructed. Whether or not such

structures are placed in intermittent or perennial streams, the biological impacts would be expected to be similar, although less severe for intermittent stream faunas.

Problems associated with culverts generally concern their potential to prevent free movement of fishes through such structures. Most fishes are relatively mobile, capable of moving up and down a stream, although many individuals live out their lives in a single pool or riffle area. While culverts may interfere with movement, they would not be anticipated to significantly affect spawning success. The linear nature of streams, however, is conducive to recolonization of biologically barren areas by fishes from upstream and/or downstream populations. Poorly designed culverts can interfere with such recolonization.

Major hindrances of culverts originate in their slope and base height. McLellan (1970) has concluded that a culvert set in a slope of 5 degrees or less and less than 50 feet long allowed "good" passage by fish, while longer culverts with steeper slope were not rated "good."

A second hindrance to fish movement is the height of the base of the culvert. If a culvert base is set below the streambed, it will likely become partially filled with silt or debris. To avoid this, culverts are often set higher. Such a higher setting can cause a barrier to fish movement at the downstream terminus of the culvert, since during low or normal flows a vertical drop may exist. A drop of 1 foot may eliminate upstream movement of most fishes. The vertical drop is eliminated during periods of high flow, but discharges are then sufficiently large to preclude most fish migration.

Since aquatic insects (the dominant invertebrates in project area

streams) are not limited to their streams as an avenue of migration, no significant impacts to their populations would be anticipated.

3.B COAL GASIFICATION PLANT AND ASSOCIATED FACILITIES

3.B.1 VEGETATION

Construction

The lease boundary of the proposed coal gasification plant includes 3,372 acres of prairie grassland and 310 acres of agricultural lands (improved pasture). Approximately 830 AUMs exist on the proposed plant site. Permanent surface facilities would be situated on approximately 815 acres. This 815-acre site is covered entirely by prairie grassland vegetation and contains approximately 163 AUMs. The remaining 2,867 acres within the proposed plant site lease boundary would be undisturbed, and present land use (grazing) would be allowed to continue.

All of the project's permanent facilities would be situated in the Eastern Powder River Basin, which comprises 4,989,560 acres in Campbell and the portion of Converse County north of the North Platte River. According to the U.S. Bureau of Land Mangement (1979), 4,188,150 acres of grassland similar to the proposed plant site exists in the basin. The removal of 815 acres at the plant site represents only a 0.02 percent reduction in prairie grassland vegetation in the Eastern Powder River Basin. Consequently, the effect on vegetation is considered insignificant and localized.

Operation, Maintenance, and Abandonment

Brine, which would be released from the plant stacks, could affect grassland vegetation in the vicinity of the plant site. Although it is uncertain how much (if any) vegetation would be lost

due to this air emission, the effect would most likely be localized. Because of the large amount of grassland vegetation in the region (4,188,150 acres), the effect is anticipated to be insignificant although long term.

Other impacts which could result from routine operation, maintenance, or abandonment of the proposed coal gasification plant include dust (including ash and coal) and herbicide effects. These impacts were described generically in Section 3.A.1 and are considered localized and insignificant.

3.B.2 TERRESTRIAL WILDLIFE

Construction

The 815 acres occupied by the plant would be fenced and lost from production for the life of the project (35 years). The quality and usefulness of habitat in the remaining undisturbed 2,867 acres would be reduced due to noise, traffic, dust, and a general increase in human activity. The "zone of influence" of the proposed plant site probably includes the entire 3,682 acres previously described in Section 2.A.1.

Impacts to passerine birds, amphibians, and reptiles are described generically in Section 3.A.2 and are not discussed below. Impacts to these animals, although locally severe at the site, are expected to be regionally insignificant.

Big Game. Construction of the proposed coal gasification plant would eliminate approximately 815 acres of year-round habitat for mule deer and pronghorn antelope for the life of the project. There is no critical habitat for either big game species in the vicinity of the proposed plant, and proposed fencing would not restrict migration

routes (Wyoming Game and Fish Department 1980a). The zone of influence (the area of habitat that is not physically altered but where the value and usefulness is reduced due to noise, dust, harassment, etc.) would probably include the entire 3,682 acres within the property lease boundaries.

The proposed coal gasification plant would occupy a relatively small portion of the Lance Creek mule deer herd unit. Essentially all occupied areas within the Lance Creek herd unit provide year-round habitat, and there is little difference between summer and winter range (Wyoming Game and Fish Department 1978). The only noticeable difference in the seasonal distribution of mule deer is a tendency for deer to concentrate along drainages during winter, especially during periods of heavy snow. No such concentration areas exist on the proposed plant site (Helms 1981). Currently, the Lance Creek herd unit includes about 10,000 animals (Wyoming Game and Fish Department 1978) and covers approximately 2,706 square miles (1,550,000 acres). Construction of the proposed plant would reduce the available mule deer habitat in the herd unit by less than 0.3 percent. Such a small loss, relative to the amount of available habitat, is considered insignificant. Loss of habitat could cause some mule deer to be displaced to adjacent areas; however, because of the availability of identical suitable habitat in the immediate vicinity of the proposed plant site, displaced individuals would be expected to reestablish in the alternate habitat.

Similarly, the proposed coal gasification plant would occupy a relatively small portion of the Lance Creek antelope herd unit. This herd unit covers 3,294 square miles (2,108,160 acres), and the total occupied habitat is approximately 3,220 square miles (2,060,800 acres). The proposed plant would affect less than 0.2 percent of the occupied habitat in the herd unit. Such a small loss, relative to the

amount of available habitat, is considered insignificant. Displaced antelope would be expected to reestablish in alternate habitat.

Upland Game Birds. April 1981 overflights and maps from the Wyoming Game and Fish Department (1980a) revealed that sage grouse strutting grounds are absent in the vicinity of the proposed plant site. Because critical strutting habitat would not be affected, no impacts to breeding sage grouse are anticipated. Some loss of sage grouse habitat is anticipated from construction of the plant. Loss of this habitat would cause some sage grouse to be displaced into adjacent habitat; however, this change in distribution is considered a localized impact, and the effect on regional populations would be insignificant.

Waterfowl. The lack of adequate waterfowl habitat on the proposed coal gasification plant site precludes possible construction-related impacts to these birds.

Raptors. According to the Wyoming Game and Fish Department (1980a), no known eagle or buteo nests occur in the vicinity of the proposed plant site. April and May 1981 overflights confirmed the absence of nests near the site. Some loss of hunting habitat and a localized reduction in prey would be expected during and after construction of the proposed plant. However, because suitable alternate hunting habitat occurs adjacent to the proposed site, potential impacts to raptors are considered insignificant.

Lagomorphs and Small Mammals. Ecology Consultants, Inc. (1975b) estimated 71 jackrabbits and cottontails per square mile in the vicinity of the proposed plant site. Since construction activities (leveling and grading) would cause rabbits to seek shelter rather than flee the area, we are assuming for this worst-case analysis that rabbits on the plant site would suffer 100 percent mortality. Consequently, the

initial construction-related mortality is estimated to be 90 animals. Essentially, the 815-acre plant site will be unfit for rabbit habitation for the life of the project (35 years). The loss of potential productivity of lagomorphs on this site would be approximately 3,150 animals (90 animals/year x 35 years).

WyCoalGas (1974) reported the average density of small mammals on the plant site was 9.7/acre. Consequently, direct mortality from construction of the 815-acre site would eliminate 7,900 small mammals. The 35-year projected life of the plant site would result in a potential small mammal productivity loss of 276,690 animals.

Operation, Maintenance, and Abandonment

No significant impacts to terrestrial wildlife are expected from routine operation, maintenance, and abandonment procedures at the proposed plant site. Various insignificant impacts which could occur are discussed generically in Section 3.A.2.

3.B.3 AQUATIC BIOLOGY

Construction

The temporary nature of plant site aquatic habitat limits the extent of anticipated aquatic biological impacts to those insignificant impacts discussed in Section 3.A.3.

Operation, Maintenance, and Abandonment

No significant aquatic biological impacts would be anticipated as a result of routine operation, maintenance, and abandonment procedures. Various insignificant impacts which would be anticipated are discussed in Section 3.A.3. Insignificant and potentially significant impacts associated with nonroutine operations are discussed in Section 3.G.

3.B.4 THREATENED AND ENDANGERED SPECIES

Construction

No known federally listed, proposed, or status review plant taxa occur in the vicinity of the proposed coal gasification plant site. The peregrine falcon occurs in eastern Wyoming only as an occasional migrant. Since no nesting sites occur in the vicinity of the proposed plant site and peregrines' presence in the area is infrequent, construction of the proposed plant is not anticipated to significantly affect peregrine falcons. No known bald eagle nests or roosting sites occur in the vicinity of the proposed plant site (Wyoming Game and Fish Department 1980a) although wintering bald eagles frequent the area (Oakleaf et al. 1979). Construction could alter the daily activities of a few bald eagles; however, no significant impacts are anticipated.

Prairie dog towns are lacking in the vicinity of the proposed plant site. The absence of suitable black-footed ferret habitat (prairie dog towns) precludes its possible occurrence in the affected area.

Operation, Maintenance, and Abandonment

Since additional acreages of potential habitat for federally protected species would not be affected by operation, maintenance, or abandonment procedures, no significant impacts are anticipated.

3.C WATER SUPPLY SYSTEM

3.C.1 VEGETATION

Construction

Gathering lines in the North and South well fields would temporarily disturb 233.2 acres of prairie grassland vegetation and

3.6 acres of dry reservoir bottom (assuming a 50-foot right-of-way). Since transmission lines would be constructed in proposed pipeline corridors, no additional vegetation would be disturbed. Proposed access roads associated with the water supply system would permanently disturb 156 acres of prairie grassland vegetation (assuming a 100-foot-wide corridor). Two water delivery pipelines from the North Platte intake to Combs Reservoir would temporarily disturb 4.8 acres of dry stream bottom and 7.3 acres of prairie grassland vegetation.

Construction of the water supply pipeline from the South Well Field to the plant site would temporarily disturb 262.8 acres of prairie grassland, 6.0 acres of dry reservoir bottom, 4.8 acres of riparian vegetation, 41 acres of agricultural lands, and 2.4 acres of urban and built-up lands.

Total acreages temporarily disturbed by construction of the proposed water supply system include 659.3 acres of prairie grassland, 14.4 acres of dry stream or reservoir bottom, and 4.8 acres of riparian (plains cottonwood type) vegetation. With the implementation of a successful reclamation plan, disturbances in prairie grassland vegetation would be short term. Acres of prairie grassland temporarily disturbed represent approximately 0.02 percent of the total prairie grassland vegetation in the Eastern Powder River Basin (for calculations used to determine this approximation see Vegetation in Section 3.B). Because the total acreage disturbed is small in terms of the amount of similar vegetation in the region and because the disturbances are temporary, no significant effects are anticipated to prairie grassland. Riparian vegetation (4.8 acres) would be removed at four separate stream crossings on the South Well Field to plant site water pipeline: La Prele Creek; two unnamed tributaries to the North Platte River in T. 33 N., R. 71 W., sec. 13; and the north side of the proposed North Platte River crossing. Losses of riparian vegetation

at these stream and river crossings represent locally significant impacts. The paucity of similar vegetation in the affected area makes effects to riparian vegetation significant. Although trees would be allowed to reestablish over the entire corridor, the time involved (20 years or more) indicates a long-term impact.

Completion of Combs Reservoir would inundate 622 acres of prairie grassland and 198 acres of dry stream bottom. These acres would be subject to permanent disturbance. As described above, the permanent loss of these acreages is anticipated to be insignificant in terms of similar habitat in the Eastern Powder River Basin (approximately 4,188,150 acres). The only other permanent disturbance associated with the water supply system is the potential loss of 3 acres of riparian vegetation at the North Platte intake reentry channel. Since any loss of riparian vegetation is considered a significant impact, removal of 3 acres at the reentry channel is considered a long-term impact.

Operation, Maintenance, and Abandonment

Only insignificant effects are expected from routine operation, maintenance and abandonment of the water supply system. Nonroutine effects are described in Section 3.G, and insignificant routine impacts are described generically in Section 3.A.1.

3.C.2 TERRESTRIAL WILDLIFE

Construction

Big Game. Big game species potentially affected by construction of the water supply system include pronghorn antelope, mule deer, and white-tailed deer. Year-round mule deer and antelope habitat that

would be temporarily disturbed includes 678.5 acres, while 823 additional acres would be permanently affected. No critical big game habitat would be disturbed.

The water supply system would occupy portions of three herd units: West Bill, Lance Creek, and South Converse. No critical habitat would be affected (Wyoming Game and Fish Department 1980a). Combined, these temporary and permanent losses of big game habitat represent less than 0.1 percent of the total occupied habitat in the herd units. Consequently, losses in terms of available habitat would be insignificant. Although some animals would be displaced from sites of permanent disturbance, it is anticipated that they would readily reestablish in adjacent habitat.

Construction of Combs Reservoir could have a positive effect on local big game populations by providing a year-round water supply. However, the fact that ample available water exists in the immediate vicinity (North Platte River) may reduce the significance of this positive impact.

Upland Game Birds. There are no sage grouse strutting grounds in the vicinity of proposed water supply system components. Consequently, breeding birds would not be affected. It is anticipated that some birds would be temporarily and/or permanently displaced by construction activities or habitat loss. Although such effects could be locally severe to individual birds, the impacts to regional populations are anticipated to be negligible.

Waterfowl. At full capacity, Combs Reservoir would provide approximately 820 surface acres of additional waterfowl habitat. Creation of new waterfowl habitat would result in a positive although localized impact. The significance of this positive impact is difficult to

determine because of ample existing waterfowl habitat along the North Platte River adjacent to the proposed reservoir. No adverse impacts to waterfowl are anticipated from construction of Combs Reservoir.

Adverse impacts to waterfowl could result from construction of the North Platte River crossing for the pipeline from the South Well Field to the plant site, and the North Platte River intake and reentry channel. Construction of the North Platte River crossing is scheduled for December. During mild winters large numbers of migrating waterfowl could be present at the proposed crossing. Construction during this period could cause displacement of resting waterfowl in the construction area. In addition, construction-related turbidity could affect the feeding activity of waterfowl downstream of the proposed crossing corridor. Because of the temporary nature of these effects and the availability of suitable habitat along undisturbed reaches of the river, the impacts are anticipated to be insignificant and short term.

Construction of the North Platte River intake and reentry channel could cause similar impacts to waterfowl. For reasons described above, it is anticipated that the effects would be localized, short term, and insignificant.

<u>Raptors</u>. Raptor nests and roosts in the vicinity of proposed water supply system components are listed in Table 3-3. Potentially, two golden eagle nests and one roost could be affected. Construction of proposed components could cause destruction or abandonment of these sites, and the eagles using these sites could be forced to choose other nesting and roosting sites. Although the loss of an individual golden eagle nest is a significant impact, the effect is localized and assuming alternative nest sites exist, short term, since nesting would be interrupted for only one year. The potential also

Table 3-3

RAPTOR NESTS IN THE VICINITY OF PROPOSED WATER SUPPLY SYSTEM COMPONENTS

Species	Component	Location
Golden eagle roost	Combs Reservoir at proposed dam	R. 72 W., T. 33 N., sec. 12
Red-tailed hawk nest	Green Valley to plant site proposed North Platte River Crossing	
Golden eagle nest	North Well Field	R. 70 W., T. 35 N., sec. 30 (southeast corner)
Golden eagle nest	North Well Field	R. 70 W., T. 35 N., sec. 30 (northeast corner)

Source: April and May 1981 aerial surveys and Wyoming Game and Fish Department (1980a).

exists that if construction occurred while eggs or nestlings occupied these nests a loss of progeny could occur. Such a loss represents a locally significant impact; however, the effect on regional populations is anticipated to be insignificant.

According to the Wyoming Game and Fish Department (1980a), several red-tailed hawk nests occur in the vicinity of the proposed North Platte River crossing. Loss of an unoccupied red-tailed hawk nest at the proposed crossing is insignificant; however, if the nest contained eggs or nestlings a locally significant impact would occur. The loss of an occupied red-tailed hawk nest would have an insignificant impact on regional populations.

A slight reduction in raptor prey would be expected during construction of pipelines and transmission lines. However, these losses are anticipated to be insignificant. Transmission line poles could provide additional raptor perching sites.

Lagomorphs and Small Mammals. The lagomorph density estimated by Ecology Consultants, Inc. (1975b), in the vicinity of the proposed reservoir during June 1975 was 583 per square mile (cottontails and jackrabbits, combined). Construction of the proposed reservoir would inundate 762 acres (1.2 square miles) of lagomorph habitat for the projected life of the reservoir. Filling of the reservoir would cause some direct mortality. If it is assumed that 50 percent of the lagomorphs would escape from the reservoir during filling, approximately 350 animals would be killed. The potential lagomorph productivity lost for the life of the project (35 years) as a result of filling the reservoir proper is estimated to be 24,500 animals.

An additional 57 acres of habitat would be lost during construction of the dam and spillways. Earth-moving activities would most

likely kill lagomorphs in the affected area (57 acres) since construction disturbances would probably cause the rabbits to seek the shelter of the burrows. Construction of these facilities could cause an initial loss of 52 rabbits. Assuming that lagomorphs would reinvade the spillways and dam area shortly after reclamation (2 to 5 years), the projected potential loss of productivity is probably between 104 and 260 animals.

Site-specific estimates of small mammal densities in the vicinity of the proposed reservoir are lacking. Because of habitat similarities between the plant site and the reservoir area, the plant site density (10/acre) is used for calculation purposes.

Filling of the reservoir would inundate 762 acres of small mammal habitat and undoubtedly drown an estimated 7,620 small mammals. Over the 35-year life of the project, the area's potential productivity would be reduced by 266,700 animals.

Additional direct losses (570 animals) would occur from construction of the 57-acre dam and emergency spillways. Assuming reinvasion 5 years after construction, the potential small mammal productivity lost would be roughly 2,850 animals.

Operation, Maintenance, and Abandonment

Significant adverse impacts to waterfowl could occur as a result of withdrawals from the North Platte River.

3.C.3 AQUATIC BIOLOGY

Construction

Construction activities in the North Well Field would be expected to result in insignificant impacts identified in Section 3.A.3.

Aquatic habitat is more extensive in the South Well Field, and as a result anticipated aquatic biological impacts would be slightly more severe, although they would be localized and short term. A "substantial fishery resource" exists in both Little Box Elder and La Prele creeks (U.S. Fish and Wildlife Service and Wyoming Game and Fish Department 1978). During construction activities, fish would be expected to emigrate from areas affected by elevated turbidity levels. Some benthic invertebrates would be smothered, resulting in a short-term decrease in benthic densities. Fish would be expected to recolonize affected areas after turbid water conditions subsided.

Impacts anticipated as a result of construction of water supply system access roads, transmission lines, and water pipelines are discussed in Section 3.A.3. Combs Reservoir construction activities in the Soldier Creek basin would result in the disturbance and/or elimination of some intermittent aquatic habitat, siltation, and the introduction of non-point source pollutants. The potential also exists for petrochemical spills at the construction site, although impacts would be localized and insignificant. Construction-related silt and non-point source pollutants would be introduced into the North Platte River. However, these pollutants would be quickly diluted, and no significant impacts to aquatic biota are anticipated. The intermittent nature of Soldier Creek precludes the existence of substantial aquatic resources; consequently, all construction-related impacts are anticipated to be insignificant. A relatively small amount of potential spawning habitat would be lost during construction of Combs Reservoir. The Soldier Creek basin may be used in some years as a springtime spawning area by fishes indigenous to the North Platte River; however, it is unlikely that the available spawning habitat is critical to any of the fishes.

Construction of the proposed reservoir would create lentic habitat and subsequently improve conditions, in terms of available aquatic habitat, in the affected area by creating a nearly permanent water body.

Aquatic biological impacts anticipated as a result of construction of the North Platte River intake complex would be similar in nature to those described for stream crossing construction in Section 3.A.3. It is expected, however, that the period of time required for construction would be longer than the pipeline construction period due to the size and complexity of the intake unit. It is likely, therefore, that anticipated impacts would be detectable for a longer period of time, and if construction coincided with fish or invertebrate spawning periods some early life stage mortality would be expected. Such impacts are anticipated to be short term in nature and regionally insignificant.

Operation, Maintenance, and Abandonment

Insignificant impacts anticipated to be associated with routine operation, maintenance, and abandonment well field procedures are discussed in Section 3.A.3. Potentially significant impacts associated with nonroutine operations are presented in Section 3.G. Discussions of impacts associated with roads, transmission lines, and water pipelines are also presented in the sections cited above.

Hydrologic examinations of proposed well field operations indicate that there could be a 1-cfs decrease in the discharge of the Box Elder Creek. While sophisticated in-stream flow analysis techniques would be required to determine the precise extent of damage to downstream trout habitat, it can generally be concluded that any anticipated decrease in habitat would constitute a localized significant impact.

It is anticipated that the discharge of La Prele Creek below the reservoir would increase significantly, from 3.2 to 7.4 cfs. It is anticipated that this increase in discharge would be constant except for the months of August and September during dry years. This discharge increase would be expected to increase available trout habitat in La Prele Creek, which would allow for an expansion of the "put-and-take" fishery that has been established there.

North Platte River water would be pumped from the proposed intake into Combs Reservoir. Similarly, fish eggs, larvae, plankton, and aquatic insects would be transported to the reservoir. The existing fish fauna in the vicinity of the proposed intake suggests that both rough and game fishes would be introduced to the reservoir. One rough species, carp, in particular would be anticipated to do very well in this new lentic habitat. The carp is well known for its ability to monopolize reservoirs after introduction. The feeding mode of the carp generally restricts the success of more desirable species such as walleye. Consequently, the potential exists for a management problem in Combs Reservoir. Other routine operation, maintenance, and abandonment impacts are anticipated to be insignificant to the area's aquatic biota.

Three types of biological impact would be anticipated as a result of operation and maintenance of the proposed North Platte River intake: (1) entrainment, (2) impingement, and (3) habitat alteration due to potential river discharge decreases associated with intake operation. Entrainment is the drawing of aquatic biota into an intake with the collected process water. In the North Platte River it would be anticipated that phytoplankton, zooplankton, aquatic insects, fish eggs, and fish larvae would be the biota particularly subject to entrainment. The existence of an intake canal suggests that only those organisms in the confines of the canal could be entrained, but

the size and morphometry of the canal, in addition to the intake volume and velocity, would ultimately determine the physical limits of the intake's influence.

Impingement is also a characteristic of intake operation and involves drawing of larger organisms (e.g., adult and juvenile fishes) against the intake structure, primarily as a result of intake velocity. Table 3-4 presents data on those North Platte River game fishes which would be anticipated to be affected by entrainment and impingement.

Entrainment and impingement impacts have been studied at cooling-water intakes of hundreds of power plants throughout the United States (Schubel and Marcy 1978). In a review article published by Uziel (1980), it was suggested that phytoplankton and zooplankton entrainment impacts were "generally small and unlikely to cause ecosystem-wide impacts." In the same review article it was suggested that even when extensive site-specific data bases are established and ecosystem models developed, fish population impact assessments are tenuous at best (Uziel 1980).

A certain number of adult or juvenile individuals of each species listed in Table 3-4 would be expected to be impinged, and physically damaged or destroyed, by the North Platte River intake regardless of its operating regime. Additionally, a certain number of fish eggs and larvae would be entrained, and physically damaged or destroyed, if the intake operates during spawning or nursery seasons (Table 3-4). Whether or not such impacts would be anticipated to be significant (i.e., have population level effects) depends on the season of withdrawal, intake velocity, canal morphometry, and intake water volume.

Table 3-4

REPORTED SPAWNING PERIODS, SUBSTRATE PREFERENCES, EGG TYPES, NUMBER OF EGGS PRODUCED, AND INCUBATION PERIODS OF FISHES REPORTED IN THE AREA OF THE NORTH PLATTE RIVER

Fish	Spawning Period	Substrate and Location	Egg Type	Number of Eggs Produced	Incubation Period
Rainbow Trout (<u>Salmo gairdneri</u>)[a]	Feb.-May[c]	Gravel or small rubble in riffle, small tributary of larger rivers[b]	Nonadhesive[b]	909-8406[b]	101 days at 3.2°C 75 days at 4.8°C 44 days at 7.5°C 29 days at 10.3°C 27 days at 11.5°C 25 days at 12°C 21 days at 14.5°C 18 days at 15.5°C
Carp (<u>Cyprinus carpio</u>)	Start spawning at 14.5°-17°C, most active at 18.5°-20°C	Over plant beds, debris and rubble in shallow water[b]	Adhesive[b]	56.463-2,208,000[b]	4-8 days, 16.7°-18°C 50-76 hr, 11°-32°C <4 days, 22°C
Flathead chub (<u>Hybopsis gracilis</u>)	July-September[b]				
Sand shiner (<u>Notropis stramineus</u>)	June[b] July-August[b]	Clean gravel and sand[b]		Age I = 250 II = 1100 III = 1800[b]	
Fathead minnow (<u>Pimephales promelas</u>)	Start spawning at 15.6°C, continue until temperature drops to 15.6°-18.4°C in the fall[b]	Eggs attached to underside of lily pads, rocks, shingles, etc., depth at 2.5 feet[b]	Adhesive[b]	8,000-10,000 eggs in ovaries[b]	5 days[c]
Longnose sucker (<u>Catostomus catostomus</u>)	Late May-July, spawning initiated at 5°C[b]	In streams on riffles scoured clean[a], 6-11 inches deep, 30-45 cm/sec, gravel[e]	Adhesive, dimersal[e]	10,270-60,307[b]	8 days at 15°C 11 days at 10°C
White sucker (<u>Catostomos commersoni</u>)	Spring-summer[b] 10°C[e]	Riffles in streams over gravel[b]		775-111,000[b] 36,000-139,000[e] 20,000-50,000	5 days at 18°C 7 days, 15.5°-16.1°C 11 days, 13.6°C
Stonecat (<u>Noturus flavus</u>)	June - August[b]	Under stones in streams[b]	Adhesive[b]	973 average[b]	
Walleye (<u>Stizostedion vitreum vitreum</u>)[a]	Spring[d] 6.7°-8.9°C normally[e]	Bars and shoals, migrate up streams and/or smaller tributaries[b], broadcast eggs which fall into crevices[e]	Eggs initially sticky, but not after water hardening[e]	Up to 612,000[e]	12-18 days[e]

[a]Game fish

[b]Carlander 1969.

[c]Baxter and Simon 1970.

[d]Eddy and Underhill 1976.

[e]Scott and Crossman 1973.

A preliminary review of location, design, and operation information for the proposed intake indicates that significant impacts on North Platte River fisheries are possible due to the existence of an off-river approach canal (U.S. Environmental Protection Agency 1976b), anticipated high velocity conditions at the intake screens, the lack of a fish-return system, and the probability that the intake canal would act as a sediment trap. The approach canal would be anticipated to function as a fish concentration area, if not a preferential spawning habitat.

A potential reduction in North Platte River discharge of 6 cfs from operation of the North Platte intake is anticipated to reduce the amount of available river fish habitat. It is anticipated that this reduction would be equal to or less than 1.2 percent of the average flow. The precise extent of habitat impact is difficult to estimate without sophisticated in-stream flow analyses. It should be noted, however, that present irrigation and industrial water commitments and reservoir operations probably would "mask" the biological effects of such a small reduction in discharge.

3.C.4 THREATENED AND ENDANGERED SPECIES

Construction

One status review plant species (*Rorippa calycina*) could occur in the vicinity of the proposed reentry channel and the North Platte River crossing of the pipeline from the South Well Field to the plant site. *Rorippa calycina* (persistent sepal yellowcress) is currently under review for possible listing by the U.S. Fish and Wildlife Service as federally endangered or threatened (*Federal Register* 45(242):82480-82569). Dorn (1980) lists the present Wyoming distribution as "Carbon County, Wyoming, from Seminoe Reservoir to Medicine Bow." Habitat for this species is sandy river or reservoir

shorelines near the high-water mark (Dorn 1980). Dorn (1980) has suggested that this species may have been transported east through the North Platte River system. Consequently, Rorippa calycina could exist at the proposed reentry channel and at the proposed water supply line crossing of the North Platte River. Construction of these components could remove or disturb habitat suitable for this taxon and/or destroy existing populations. The potential exists for a locally significant impact to Rorippa calycina from construction of the proposed pipeline crossing and reentry channel. A survey, planned for August 1981, will determine the presence or absence of the persistent sepal yellowcress in the affected areas. Potential impacts will be reassessed after completion of the aforementioned survey.

Construction of the reentry channel and the South Well Field to plant site pipeline could also remove bald eagle perch trees from the North Platte River shoreline. The loss of individual perch trees is considered a significant impact; however, the effects are anticipated to be localized. Wintering bald eagles could be displaced from the immediate vicinity by construction-related disturbances. The impacts to the few individuals potentially affected are considered localized and insignificant.

Potential black-footed ferret habitat (prairie dog towns) exists on the South Well Field. Two prairie dog towns, each approximately 2.5 acres in size, were located in the South Well Field during aerial reconnaissance in May 1981. Even though habitat is available for black-footed ferrets, the probability of their occurrence in these dog towns is extremely remote. However, until surveys are conducted to determine their absence or presence, a tentative "may affect" conclusion must be made for the black-footed ferret as a result of construction of the water supply system.

Operation, Maintenance, and Abandonment

No effects on the black-footed ferret, peregrine falcon, or bald eagle are anticipated, since routine operation, maintenance, or abandonment procedures would not cause additional habitat disturbances. On the other hand, withdrawals from the North Platte River could affect crucial habitat for the whooping crane in central Nebraska. [We are awaiting hydrological data necessary for the assessment.]

3.D RAILROAD

3.D.1. VEGETATION

Construction

The proposed electric railroad and ancillary facilities (i.e., the electric line necessary for operation) between the proposed plant site and the Rochelle Mine would permanently remove 22 acres of plains cottonwood type and 972 acres of prairie grassland. In addition, 46 acres of agricultural lands would be lost. In terms of the amount of similar vegetation in the vicinity of the corridor, the loss of 972 acres of prairie grassland type would be an insignificant, although long-term, effect (0.02 percent of the Eastern Powder River Basin's total grassland). On the other hand, the potential long-term loss of 22 acres of riparian habitat along Antelope Creek is considered a significant, although localized, impact.

Operation, Maintenance, and Abandonment

Additional impacts to vegetation are anticipated from fugitive coal dust and ash and the use of herbicides on the railroad right-of-way. Fugitive dust resulting from railroad operation would settle on nearby vegetation. Assuming that the application of fugitive dust to

vegetation would be a continuous process, rainfall would provide only temporary relief. Fugitive dust on vegetation along the right-of-way would be a long-term, although localized, biological effect.

If fugitive dust completely covered vegetation for 200 feet on both sides of the track, then an additional effect to 972 acres of prairie grassland would be expected. Similarly, the effect is considered regionally insignificant. Impacts to the taller plains cottonwood from fugitive dust along Antelope Creek are considered insignificant.

3.D.2. TERRESTRIAL WILDLIFE

Construction

The primary impacts to wildlife associated with construction of the proposed electric railroad would result from habitat and forage loss.

Big Game. Construction of the proposed electric railroad could have a localized significant impact on mule deer. Since the railroad would exist for the life of the project, associated impacts are long term. The proposed railroad loop in the Porcupine Creek drainage would affect important mule deer winter habitat (Gassen, 1981). Although the Wyoming Game and Fish Department (1980a) did not consider the Porcupine Creek drainage as critical habitat, mule deer apparently concentrate there during winter months when forage is restricted in other areas. According to Gassen (1981), the displacement of mule deer from this area by construction and continual operation could cause some mortality among the displaced individuals. Impacts would be significant and long term but localized. The perma nent loss of forage (205 AUMs) would have little effect because of other available forage adjacent to the corridor. Loss of habitat south of Antelope Creek would

similarly have negligible impacts primarily because no critical habitat would be affected.

Upland Game Birds. The proposed railroad corridor is routed approximately 0.2 mile west of a sage grouse strutting ground (Komberak 1981). Construction impacts, although less severe than potential operation impacts, could be significant if construction in this area occurred in early spring. A worst-case assessment of the spring construction-induced impacts to the breeding birds would be complete abandonment of the lek. The loss of one local sage grouse breeding complex is considered a significant, long-term, although localized, impact.

Operation, Maintenance, and Abandonment

The primary impacts associated with operation of the electric railroad system would result from increases in human disturbance, such as noise, general harassment, and poaching. Insignificant impacts which result from these factors are described generically in Section 3.A.2.

Big Game. Since the right-of-way would not be fenced, no significant changes in big game distribution are anticipated. An initial habitat loss of a corridor 0.5 to 1 mile wide centered on the railroad right-of-way is expected due to avoidance behavior of big game species. This distance is expected to diminish as big game species become acclimated to increases in general disturbance and passing trains. This may be particularly true for pronghorn, which have been reported to browse and graze in close proximity to major activity centers.

As stated previously, operation of the electric railroad is expected to have a long-term, significant effect on wintering mule deer in the Porcupine Creek basin.

Upland Game Birds. The major impact to upland game bird populations would be disturbance to a sage grouse lek located 0.2 mile east of the proposed railroad right-of-way. A worst-case assessment of impacts resulting from increases in noise and general disturbance would be the permanent abandonment of the strutting ground. The loss of one local sage grouse breeding complex is considered a significant, long-term, localized impact.

There is a low probability that sage grouse will become accustomed to noise from passing trains and reestablish the existing lek and brooding grounds after initial abandonment. Returns to traditional strutting grounds have been reported after developments such as roads and airport runways (Harju 1979). There is a slightly higher probability that sage grouse would establish a new lek and brooding grounds in another habitat. The probability of reestablishment is dependent on the suitability and proximity of alternative strutting habitat.

Raptors. Reproductive failures (involving nesting and breeding activities) along the railroad corridor due to operation could be moderate to severe. Human disturbance has been cited as a major factor in nesting failure in a number of recent studies (Bocker and Ray 1971, Snow 1973a,b). Impacts on reproductive activity may occur at any one of several different stages. Raptors subject to high levels of human activity may abandon established nesting territories before mating or egg laying ever occur (Snow 1973a,b). Harassment of adult birds, causing them to desert the nest during incubation or brooding of the young, may also result in nest failure. Available evidence indicates that raptors most frequently and readily desert their nests during the incubation period. Once young have hatched, the probability of desertion decreases considerably.

The distances at which raptors will tolerate human activity in their nesting and hunting territories is not presently well defined. However, based on recent studies (Vicenty 1974, Boeker and Ray 1971) it is suggested that nesting and breeding activities will be affected in a 1-mile corridor on both sides of the railroad right-of-way. Based on this criterion, five golden eagle nests (Four active and one inactive) and one ferruginous hawk nest would be affected by operation of the railroad. Nests outside this corridor would probably not be adversely affected.

The worst-case assessment of nest failure within 1 mile of the railroad may be mitigated by birds relocating to alternative nests. Most raptor species maintain alternative nest sites and may occupy the other sites if they are disturbed at the primary nest.

No significant impacts are expected to the golden eagle/bald eagle winter roost located 1 mile east of the proposed rail line. Two factors contribute to this conclusion: (1) the roost is located on the outer boundary of the "sensitive" zone described above; and (2) raptors are not particularly susceptible to disturbance during non-reproductive periods, and if they are displaced, reproductive potential is not threatened.

An additional adverse impact of the proposed railroad line may be the increased possibility of raptor shooting. Juvenile raptors are in general more tolerant of human presence than adults. This lack of wariness often places them within range of firearms and makes them easy targets. They tend to perch in accessible places, such as on poles along the rail line, which increases their vulnerability to shooting.

Raptor electrocution can represent a serious mortality factor when improper design of transmission lines places ground and hot sources within 7 feet of each other. Since the ground and hot leads of the proposed transmission line would be 10 feet apart, raptor electrocution would be virtually impossible.

3.D.3. AQUATIC BIOLOGY

Construction

Impacts anticipated as a result of railroad construction are discussed in Section 3.A.3.

Operation, Maintenance, and Abandonment

Fugitive coal dust and coal ash are anticipated to enter local aquatic systems as a result of normal operation of the railroad. Increases in the turbidity of nearby streams would result from the physical presence of these particles. The intermittent nature of the streams in the area of the proposed railroad restricts the presence of aquatic biota to periods when water is flowing, which coincides with the period when coal dust and ash would occur in the greatest concentrations from runoff. The increases of suspended solids directly attributed to the operation of the railroad would probably be insignificant due to the low levels attributed to operation, present ambient levels, and the limited aquatic fauna. No significant aquatic biological effect would be anticipated as a result of routine operation, maintenance, or abandonment procedures. Potentially significant impacts anticipated as a result of nonroutine operations are discussed in Section 3.G.

3.D.4. THREATENED AND ENDANGERED SPECIES

Construction

There are no known federally listed, proposed, or status review plant taxa in the vicinity of the proposed railroad corridor.

There are no known bald eagle nests in the vicinity of the proposed railroad corridor. However, a major bald eagle/golden eagle winter roost occurs approximately 1 mile east of the proposed corridor. Because the distance between the roost and corridor places the roost out of the sensitivity zone, no significant impacts are anticipated. Wintering bald eagles could be encountered along most of the railroad corridor, especially at the proposed Antelope Creek crossing. Construction of the proposed rail line could affect the bald eagle in two ways: removal of perch trees at river and stream crossings, and displacement of individual bald eagles from the construction area. The removal of perch trees represents a localized impact which would be insignificant if other suitable perch trees exist in the affected area. If construction removed the only perch tree in the vicinity of the proposed crossing, the impact would be locally significant. However, such an isolated case is highly unlikely. Displacement of individual eagles would be significant only if other available habitat is lacking. Displaced individuals would most likely settle on other stream or river reaches until construction was completed.

The proposed railroad corridor would traverse or pass within 1 mile of 11 prairie dog towns, all of which occur within Thunder Basin National Grasslands. A total of 2,016.6 acres of prairie dog towns lie within 1 mile of the railroad right-of-way. Only 4 of the towns would actually be traversed. In theory, all of these towns provide potential black-footed ferret habitat. However, in actuality, the probability of a ferret occurring in any of these towns is extremely remote. Until ground surveys can be conducted to verify the presence or absence of the black-footed ferret in the area of influence, a tentative "may affect" conclusion must be made.

Operation, Maintenance, and Abandonment. Noise and other disturbances associated with operation of the electric railroad could

affect bald eagles, especially in the vicinity of Antelope Creek. However, a certain degree of acclimation is expected, and the impacts are anticipated to be insignificant.

3.E MINE AND ASSOCIATED FACILITIES

3.E.1. VEGETATION

Construction

Mine support facilities (buildings and sizing facilities) would be located mostly in T. 41 N., R. 70 W., sec. 16. This section is not underlain by an economically removable coal reserve; consequently, only minimal surface disturbances are expected. Most of these surface facilities would be situated in scoria vegetation.

Operation, Maintenance, and Abandonment

Estimates of the percentage of the regional vegetation resources lost due to coal extraction at the Rochelle Mine are summarized in Table 3-5. Upland grass and breaks vegetation that would be lost on the mine site is about 0.1 percent of the sagebrush-grass vegetation type in the Eastern Powder River Basin (U.S. Bureau of Land Management 1979). Similarly, the removal of 93 acres of ponderosa pine would reduce the basin's resource by less than 0.03 percent. Impacts to each of these types are considered insignificant in terms of the effect on the regional vegetative communities. However, these impacts would be locally severe, especially in relation to the loss of local wildlife habitat.

The loss of 1,348 acres of scoria vegetation represents 4.9 percent of the basin's resource (Table 3-5). Playa vegetation in the Eastern Powder River Basin would be reduced by 24 percent. These losses are anticipated to be permanent, since the areas would be re-

Table 3-5

ESTIMATES OF ACREAGES OF EACH VEGETATION TYPE IN THE EASTERN POWDER RIVER BASIN

Vegetation Type	Acres in Eastern Powder River Basin[a]	Maximum Acres Affected at the Rochelle Mine	Percent of Regional Vegetation Affected at Mine
Sagebrush-Grass[b]	4,188,150	5,030	0.1
Scoria	27,300	1,348	4.9
Ponderosa Pine	328,400	93	0.03
Playa	329[c]	79	24.0

[a]Source: U.S. Bureau of Land Management 1979.

[b]Includes upland grass and breaks types on the Rochelle Mine site.

[c]The U.S. Bureau of Land Management (1979) estimated 250 acres of playa in the Eastern Powder River Basin. This estimate does not include the 79 acres on the Rochelle Mine site. Calculations have been corrected to account for the increased acreage in the basin.

claimed to grassland habitat after mining is complete. These losses represent significant, long-term reductions in the quantity of scoria and playa vegetation in the Eastern Powder River Basin.

The first mining operation involves the removal of topsoil. During the first cuts, the topsoil would be stored for future use in reclamation. When soil is removed for stockpiling and future reapplication, organic materials will become incorporated into the soil. The consistency of the soil will change, resulting in a positive reduction in the erodibility of the soil. Soils susceptible to erosion are often stabilized to some degree through the addition of organic matter (Moore and Mills 1977). Prolonged storage of topsoil can have adverse effects on the microbial populations inhabiting the material. This potential impact would be reduced when the mining operation reaches a steady state. After the first few years of mining, it would not be necessary to store topsoil, since the topsoil would be transferred directly to areas which have been regraded and are ready for revegetation. This direct transfer method should significantly increase the probability of early revegetation success. The transfer of topsoil would occur only in the spring or fall when favorable moisture conditions exist. Wind erosion would be reduced by mulching.

WyCoalGas is committed to conducting species adaptation studies on the mine site in order to determine which plant species are best adapted for revegetation in the area. Because the major land use in the area is livestock grazing, high-yield grazing species such as Russian wild rye, crested wheatgrass, bromegrass, and orchardgrass may also be introduced to provide better forage. Cover crops may also be introduced to control erosion in revegetated areas.

Airborne effluents in the form of gaseous emissions and fugitive dust would be produced by mining and associated operations at the

Rochelle Mine. Operation of heavy equipment, haul trucks, and other vehicles will produce gaseous emissions. Exhaust from this equipment will contain potentially harmful gases such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) and heavy metals such as lead.

Ponderosa pine is particularly sensitive to SO_2, and NO_x. Symptoms which can result from acute exposure of sensitive flora to SO_2 and NO_x include foliage damage and leaf drop. Foliar chlorosis and necrosis, and a concomitant reduction in photosynthesis and production, can result from chronic exposure.

Under normal operating procedures, SO_2, NO_x, and CO emissions from coal mining equipment are not anticipated to cause detectable effects on vegetation. Any effects that did occur would be expected to be extremely localized and restricted to areas immediately adjacent to the mine and access roads. Lead contamination would decrease with increasing distance from roads and work areas, but prevailing winds would alter this pattern to a certain degree. Impacts on vegetation from lead and other gaseous emissions of mining equipment are expected to be localized, insignificant, and undetectable during normal operational procedures.

Fugitive dust, composed of soil, overburden, waste rock, and ore, would result from cleaning, mineral extraction, stockpiling, and transportation activities at the mine site. Fugitive dust concentrations are expected to be highest during land clearing, blasting (if necessary), along access roads, and near coal transportation corridors. Dust produced in the pit would be largely contained by pit walls. Generally, fugitive dust effects are anticipated to be localized in areas immediately adjacent to roads, coal transportation corridors, and the

mine site. The area of influence depends on the success of dust control measures, such as watering.

Dust from the exposed ore body would represent only a small portion of the total dust emanating from the mining activity. The majority of the fugitive dust would be composed of soil, overburden, and waste rock materials raised by vehicular movement activities in and adjacent to the mine and associated facilities.

The most obvious effect of fugitive dust on the adjacent flora is coating of the foliage. In extreme cases, photosynthetic activity can be reduced or inhibited when the dust coating reduces light penetration and gas exchange. Rainfall would provide only temporary relief since the dust application is expected to be continuous for the life of the mine.

Most of the fugitive dust raised during mineral extraction would settle on adjacent areas that would be mined at a later date. However, some dust is expected to settle on vegetation outside the mine boundary. The prevailing wind in the vicinity of the proposed Rochelle Mine site is from northwest to southeast. Most of the fugitive dust raised during mine operation and carried beyond the mine boundaries would settle on the breaks and in the Beckwith Creek drainage, which supports some ponderosa pine vegetation. Impacts to vegetation outside the mine boundary from fugitive dust are expected to be regionally insignificant although long term. Dust effects would be significantly reduced by the application of 200,000 gallons of water daily to coal haul roads.

3.E.2 TERRESTRIAL WILDLIFE

<u>Construction</u>

Construction of the mine facilities is not anticipated to have significant effects on wildlife species. The effects of construction

are overshadowed by operation of the mine in the same area. Operation includes the entire coal extraction process and reclamation. These impacts are discussed in detail below.

Operation, Maintenance, and Abandonment

Impacts to wildlife due to removal or destruction of vegetation from surface mining activities can be generally summarized as follows:

- Loss of cover
- Direct loss of species unable to escape construction and development disturbances (mainly small mammals, amphibians, and reptiles)
- Displacement of more mobile species (antelope, deer, raptors and other birds, and larger predators)
- Loss of food on which primary consumers depend
- Loss of prey for predators and raptors

More indirectly, overcrowding and competition for food and cover could occur in adjacent habitat as a result of displacement. A decrease in nutrient and energy flow into adjacent areas would reasonably be expected.

Animals destroyed during vegetation removal are described below under Lagomorphs and Small Mammals. These small mammals constitute an important prey base for larger predators and raptors. Consequently, any loss represents a decrease in food for larger avian and mammalian predators. The effects of these small mammal losses on predators are

difficult to predict, primarily because these species are wide ranging. If, however, the food source in the area of the Rochelle Mine is the primary factor limiting population size, then some reduction in the number of predators could be reasonably expected (Hariston et al. 1960).

Operation, Maintenance, and Abandonment

Big Game. The Rochelle Mine site is situated in the Thunder Basin mule deer and antelope herd units (Wyoming Game and Fish Department 1978). Presently 1,097,088 acres of the Thunder Basin antelope herd is occupied habitat. The area, including the proposed Rochelle Mine site, is used year-round by antelope (Wyoming Game and Fish Department 1980a). However, extensive surveys conducted by Econ Inc. (1980a) failed to locate antelope on the mine site proper during winter. Econ Inc. (1980a) concurred with the year-round use but suggested that a large portion of the local population appears to winter elsewhere.

The proposed 6,550-acre mine site represents approximately 0.6 percent of the total occupied habitat in the Thunder Basin antelope herd unit. However, impacts associated with development and operation of the Rochelle Mine cannot be entirely contained within the 6,550 acres proposed for mining. The zone of influence (due primarily to indirect impacts related to human presence, dust, and noise) would extend for some distance around the 6,550-acre site. Although it is impossible to accurately estimate the size of the zone of influence, a factor of 2.5 has been used for the worst-case analysis. Consequently, the worst-case calculation for antelope habitat lost directly and indirectly from development and operation of the Rochelle Mine is 1.5 percent of the occupied herd unit. In terms of the percentage of available habitat lost, development and operation of the Rochelle Mine

would have an insignificant localized, although long-term, effect on antelope.

The total occupied area in the Thunder Basin mule deer herd unit is 1,916,600 acres. The 6,550-acre mine site that would be directly affected by development and operational disturbances represents 0.3 percent of the total occupied habitat in the herd unit. Again, using the 2.5 factor for the zone of influence, it is calculated that for the worst case 0.8 percent of the presently occupied range would become unsuitable for mule deer habitat. In itself, the 0.8 percent reduction in habitat would represent an insignificant localized, long-term effect. However, according to Walt Gassen (1981) of the Wyoming Game and Fish Department, the Porcupine Creek basin, which lies in the zone of influence, is important winter habitat for the local mule deer population (Figure 2). Indirect impacts (noise and increased human presence) in this area would have a significant and long-term, although localized effect on mule deer.

White-tailed deer and elk are uncommon in the vicinity of the proposed mine, and the only sightings in the area have been off the proposed mine site (Econ Inc. 1980). Neither species would be affected directly by mine development or operation; however, some white-tailed deer have been sighted within the projected zone of influence in riparian habitat along Antelope Creek (Econ Inc. 1980a). Indirect effects on white-tailed deer due to noise and increased human presence are anticipated to be insignificant.

Upland Game Birds. According to Econ Inc. (1980a) development of the Rochelle Mine would remove one sage grouse lek on the edge of a playa in the northeastern corner of the proposed mine site (Figure 2). Econ Inc. (1980a) summarized that "although sage grouse are not overly abundant on the overall area, the location of the strutting ground and

recorded observations indicate that some sage grouse habitat exists within the intensive unit."

The loss of this strutting ground is anticipated to have a long-term, significant effect on local sage grouse populations. If suitable strutting habitat is available outside the zone of influence, the birds may establish a new lek. If suitable habitat is lacking, the local population would be expected to disperse, significantly reducing the local resource. In either case, a significant reduction in sage grouse in the immediate vicinity of the mine is anticipated. The loss of a single lek, however, would have an insignificant effect on regional populations.

Waterfowl. Development of the Rochelle Mine would not significantly affect local or regional waterfowl resources due to the paucity of suitable habitat in the projected zone of influence of the proposed mine.

Raptors. Surface disturbances on the Rochelle Mine would destroy two golden eagle nests. A third golden eagle nest could be adversely affected by construction activities on the mine site.

Raptors typically maintain alternative nesting sites, and the nesting eagles on or near the mine site would be forced to choose either an existing alternative nest site or a new nesting location. In either case, loss of existing nests would probably cause a loss of at least one year's progeny. As a rule, each pair annually produces two offspring (Williams and Matteson 1973). The worst-case analysis suggests that potential productivity from affected nests would be reduced by 6 birds, assuming displaced birds are able to find suitable nesting habitat the following year. According to the U.S. Bureau of Land Management (1979) and the Wyoming Game and Fish Department

(1980a), there are 39 active and inactive golden eagle nests in the Eastern Powder River Basin. Removal and disturbance of the 3 nests mentioned above would reduce the number of nests in the basin by 7.7 percent. The loss would represent a significant regional effect. The impact, however, could be mitigated by relocating the affected nests.

Small mammal and lagomorph losses on the mine site could adversely affect the area's raptor prey base. However, because these losses are restricted to a relatively small area and ample hunting areas exist elsewhere, the effect on the regional raptor population is anticipated to be extremely localized and insignificant.

Lagomorphs and Small Mammals. Ecology Consultants, Inc. (1974a), estimated the August density of lagomorphs on the Rochelle Mine site at 398 per square mile (cottontails and jackrabbits, combined). The total area of the proposed mine is approximately 10.2 square miles; however, surface disturbances would be restricted to approximately 8.1 square miles. Rabbits tend to retreat to burrows when disturbed and, consequently, only a few would be expected to escape the mining activity.

The maximum acres to be disturbed is 128 annually. Using this figure, the annual loss would be approximately 80 animals. Assuming that reclaimed areas would again be suitable for lagomorphs 5 years after the initial disturbance, the loss of potential productivity over a 5-year period would be about 400 animals. The life of the mine is projected to be 42 years, but actual mining and surface disturbances would be limited to a 40-year period. An additional 5 years would be required for the reclamation of the last area mined. Consequently, the estimate of the potential lagomorph productivity lost as a result of coal extraction at the Rochelle Mine is 18,000 animals for the life of the project.

The calculations do not take into account factors which could increase or decrease the estimated losses. However, since the calculations are based on 100 percent mortality (no escape), these estimates represent the worst case. In addition, some cottontails and jackrabbits are expected to reinvade reclaimed areas sooner than the 5-year criterion used here. Consequently, losses of potential productivity may be lower than estimated.

Small mammal densities on the Rochelle Mine site vary among major vegetation types (Econ Inc. 1980a). The upland grass areas support 11 small mammals per acre, while the breaks area supports 35 per acre. In the scoria type, Econ Inc. (1980a) failed to collect small mammals during density determination field surveys. However, during qualitative surveys, several species were captured or observed in the scoria type. For the purposes of this report, the weighted mean density of the upland grass and breaks vegetation types (24/acre) was chosen to represent the entire mine area. The number most likely represents a worst-case estimate, since the unknown scoria density is anticipated to be well below the weighted mean.

The maximum acreage which would be disturbed annually is 128. Using this figure, the projected annual loss is expected to be 3,070 animals. If it is assumed that the reclaimed areas would again be suitable for small mammal habitation 5 years after the initial disturbance, the loss of potential small mammal productivity as a result of each year's mining activities would be about 15,350 animals.

Mining surface disturbances and reclamation (including reclamation after the last mining year) would occur over a 45-year period. The estimate of potential small mammal productivity lost over the life of the mine is 690,750 animals.

The composition and origin of fugitive dust on the mine site, access roads, and coal transportation corridor were previously discussed in the vegetation impact assessment section. Fugitive dust emissions will be restricted to areas immediately adjacent to the mine, access roads, and coal transport systems. Ingestion of dust-covered leaves can increase tooth wear in herbivores. Tooth deterioration is an important contributor to death and disease in ungulate populations. Consequently, increased dust levels could be detrimental to mule deer, pronghorn, and possibly some small herbivores. However, impacts would most likely be insignificant, since noise produced during operation of these dust-producing components would displace most wildlife from the dust-covered areas.

The most serious effect on wildlife exposed to dust is probably its harmful effect on mucous membranes. Tears are often inadequate to alleviate chronic eye irritation which can be caused by the abrasive action of large particles. Immediate and long-term pulmonary function changes can occur as a result of exposure to heavier dust. The limited distribution of fugitive dust and displacement of wildlife from these areas indicates impacts would be localized and insignificant.

Potentially harmful gases such as SO_2, NO_x and CO would be emitted from heavy and light equipment operating on the mine site. Under normal operation, these emissions are not anticipated to reach concentrations sufficient to cause detectable effects to wildlife. Any effect would be extremely localized and restricted to wildlife species immediately adjacent to the mine, access roads, and coal transportation corridors. Exposure is anticipated to be short term, since mobile species sensitive to noise and human activity would most likely be displaced by the noise associated with operation of the equipment. No detectable impacts to wildlife are anticipated from gaseous emissions related to development and operation of the mine

site.

3.E.3 AQUATIC BIOLOGY

Construction

The proposed mine plan includes the diversion of two intermittent streams: Porcupine Creek and the stream in Knapp Draw Valley. Porcupine Creek would be diverted around the proposed railroad loop. The Knapp Draw Valley diversion would be located in the northwestern corner of the mine. Potential impacts associated with the diversion of these streams include habitat alteration, sedimentation, petrochemical spills, and non-point source pollutant contamination.

Aquatic biological impacts associated with sedimentation, petrochemical spills, and non-point source pollutants would be anticipated to be insignificant due primarily to the temporary nature of these drainages. Habitat alteration in the channelized stream sections, however, would be considered a localized, long-term, significant impact since it would be expected to eliminate the natural stream riffle-pool sequence. This habitat alteration, in turn, would further decrease the limited productivity of these streams. Some degree of habitat recovery would be anticipated after spring runoff has eroded pools and runs into the channelized sections.

Other potentially affected intermittent and/or ephemeral streams would be eliminated or modified into sediment channels or ponds. These alternations would be anticipated to be significant, localized impacts which would be evident for the life of the coal mine. It is important to note, however, that these stream modifications are necessary in order to mitigate potential impacts associated with coal mine runoff.

Operation, Maintenance, and Abandonment

It is anticipated that operation of the mine would result in increased sedimentation (soil, coal, and coal ash), petrochemical spills, non-point source pollutants and biocide contamination. The 10 sediment ponds which have been proposed would be expected to concentrate most of these materials and avoid watershed contamination outside the mine boundary. It is anticipated that this sediment control program would minimize the potential for significant aquatic biological impacts outside the mine boundary. These on-site sediment control drainages, however, would be altered for the life of the mine.

It is anticipated that coal and coal ash would enter Porcupine Creek as fugitive dust and mine area runoff. This sediment load increase would be expected to further stress this intermittent and silted stream habitat. This general habitat degradation of Porcupine Creek, however, is not anticipated to result in significant biological impacts, since the extant aquatic community is limited and temporary.

Ash at the mine site would be discharged into an underground hopper. From the hopper, ash would be delivered to a stockpile by a conveyor and then trucked to the disposal site. This method of transportation would be anticipated to limit the introduction of this ash into watershed streams.

3.F PRODUCT PIPELINE

3.F.1 VEGETATION

Vegetation

Construction. The most severe impacts on vegetation would occur during construction of the proposed product pipeline. Vegetative associations affected by the proposed corridor include prairie grass-

land, ponderosa pine forest, riparian (plains cottonwood type), dry stream bottom, agricultural lands, and urban and built-up lands. Depending on the vegetation type affected, several impacts may be apparent for some time after construction has been completed.

Construction of the proposed pipeline right-of-way would require the removal of 1,608.7 acres of natural vegetation (363.4 acres of agricultural and urban and built-up lands would also be affected). As a result of clearing the right-of-way, changes could occur in at least two vegetative characteristics: type and abundance of soil cover, and primary productivity.

South of the North Platte River crossing, approximately 1.7 acres of riparian vegetation (plains cottonwood type) would be eliminated. Because of the paucity of riparian vegetation in eastern Wyoming, the impact would be significant although localized. Since reestablishment of tree species in the corridor could take as long as 20-50 years, the effect is considered long term.

Approximately 97.5 acres of ponderosa pine forest would be eliminated by construction of the product pipeline. Ninety-five percent of the pine forest vegetation which would be affected has a relatively open canopy with a prairie grassland understory. Construction through these areas would remove relatively few trees, and impacts would be insignificant. Approximately 4.8 acres of pine forest with a closed canopy would be removed. Although tree loss in these areas would be greater than in more open areas, the impacts would be regionally insignificant because of the large amount of simi lar pine forest vegetation existing adjacent to the disturbed area. Impacts to pine forest, however, are considered long term because trees would require as long as 30 years to reestablish over the corridor.

The vast majority of the affected vegetation would be the prairie grassland type (1,473.5 acres, or 88 percent of the affected vegetation). Impacts to this type are considered insignificant, short term, and localized.

While vegetation concerns could be locally significant during construction, actual impacts on vegetation would be generally insignificant and, for the most part, temporary with a successful reclamation program. Successful revegetation and reestablishment of grazing would be expected to occur in most areas along the proposed pipeline route with implementation of an erosion control and revegetation plan. From one to five years would be required for a stand of vegetation to become established. Longer periods of time may be required when unfavorable weather conditions occur. In some small areas, partial success of revegetation would result in less dense vegetation.

Operation, Maintenance, and Abandonment

Since routine maintenance would not be required in the pipeline corridor, no effects to vegetation are anticipated.

3.F.2 TERRESTRIAL WILDLIFE

Construction

Big Game. Impacts to big game would most likely result from habitat loss and construction-related displacement. Construction of the proposed product pipeline would temporarily reduce big game habitat in eastern Wyoming and northeastern Colorado by 1,608.7 acres (prairie grassland, ponderosa pine forest, dry stream bottom, and plains cottonwood habitat). This loss of habitat would occur in Converse, Platte, and Laramie counties, Wyoming, and in Weld County, Colorado. This portion of eastern Wyoming and northeastern Colorado provides

year-round habitat for mule deer and antelope. No critical habitat would be affected (Wyoming Game and Fish Department 1980a).

AUMs which would be temporarily lost due to construction-related disturbances of the 100-foot-wide product pipeline corridor are presented in Section 2.C (Table 2-39). Most of the pipeline corridor lies in an area where grassland habitat supports 0.3 AUM/acre. A smaller portion of the route through Converse County and northern Platte County (roughly from MP 0 to Cedar Top Butte and Sheep Mountain) is in the 10- to 14-inch Northern Plains precipitation zone. These grasslands support approximately 0.2 AUM/acre.

According to calculations presented in Table 2-39, construction of the product pipeline would result in a temporary loss of 430 AUMs. In terms of available big game forage, the corridor could hypothetically support 2,494 mule deer or 4,128 pronghorn antelope. In actuality, the majority of these 430 AUMs are undoubtedly allocated to cattle or sheep production. Most likely overgrazing by livestock is causing the present range condition to deteriorate. Consequently, the forage which would be temporarily removed from the pipeline corridor probably represents only a very small portion of the forage used by big game herds in the vicinity of the right-of-way. In addition, these 430 AUMs are distributed over 162.7 miles. In other words, each 10-mile section of corridor would temporarily remove only 2.6 AUMs.

The proposed product pipeline corridor would traverse four mule deer herd units: Lance Creek, Muskrat, Goshen Hole, and Cheyenne. The management herds occupy nearly 4,500,000 acres. If only 50 percent of the area in each of these herd units was actually occupied, then at least 2,500,000 acres of mule deer habitat exist in the affected area. A loss of 1,608 acres of habitat represents less than 0.07 percent of the available habitat. Actually, the percentage of

occupied habitat in each herd is probably much greater (see Section 3.B). Consequently, impacts to available big game forage and habitat which would result from construction of the proposed product pipeline are insignificant and short term. Initial construction activities would displace big game species in the construction zone of influence. Within a few weeks after construction ceases, these animals should become adjusted to the cleared areas. As grass and shrubs are restored, these species would be attracted to the right-of-way and may be expected to again utilize the construction corridor.

Impacts to big game which could result from construction of the proposed product pipeline are considered insignificant and short term.

Upland Game Birds. Based on April 1981 aerial surveys and data from the Wyoming Game and Fish Department (1980a), there are no known sage grouse strutting grounds in the vicinity of the proposed pipeline corridor. No construction-related impacts are anticipated to strutting birds. Some habitat used by upland game birds, particularly sage grouse and turkey, could be disturbed. However, it is anticipated that these small losses would represent an insignificant amount of the occupied habitat, and impacts would be insignificant and short term.

Waterfowl. The proposed summer pipeline construction schedule would preclude significant impacts to migrating waterfowl. However, some waterfowl or water-associated bird species could be displaced at major stream crossings. The impacts to these displaced birds would be short term, localized, and insignificant.

Raptors. Two golden eagle nests have been identified within less than 0.5 mile of the proposed product pipeline corridor. All other nests identified in the vicinity of the proposed corridor are at least 2 miles from the right-of-way. Construction crews would approach the

golden eagle nest in T. 30 N., R. 66 W., sec. 29 (Cedar Top Butte), six weeks after construction is initiated at MP 70. Young golden eagles are typically fledged 15 weeks after eggs are laid. In Wyoming, most eggs are laid in early March; consequently, fledging would be expected to occur before mid-June. If pipeline construction was initiated at MP 70 before early May, golden eagles could be forced to abandon their young in the nest on Cedar Top Butte. If construction occurred after the first week in May (assuming a 5 miles/week construction rate), no impacts would be expected since the young would have left the nest. If the young were abandoned, the effect would be significant although localized in nature.

It would take nearly eight weeks for construction crews to approach the golden eagle nest in T. 19 N., R. 66 W., sec. 11. Construction would have to be initiated prior to mid-April for an effect to occur on this particular nest.

Operation, Maintenance, and Abandonment

Maintenance of the proposed pipeline would have negligible impacts. No ground work or additional surface disturbances would be required during routine operation and maintenance of the product pipeline. Consequently, no additional impacts to wildlife are anticipated. Nonroutine operational impacts are described in Section 3.G.

3.F.3 AQUATIC BIOLOGY

Construction

Impacts anticipated as a result of product pipeline construction are discussed in Section 3.A.3.

Operation, Maintenance, and Abandonment

No significant aquatic biological impacts are anticipated as a result of routine operation, maintenance, and abandonment procedures. Impacts anticipated as a result of nonroutine operations are discussed in Section 3.G.

3.F.4 THREATENED AND ENDANGERED SPECIES

Three federally protected wildlife species and two status review plant taxa could occur in the vicinity of the proposed product pipeline. A May 1981 aerial reconnaissance of the proposed pipeline corridor revealed two prairie dog towns within 1 mile of the proposed right-of-way. One town is approximately 230 acres; the other is about 30 acres.

These two prairie dog towns are potential habitat for the black-footed ferret. Clark (1973) reported six ferret sightings in Converse, Platte, and Laramie counties, Wyoming, between 1851 and 1973. The most recent sighting was reported from Platte County near Shawnee in 1948. Clark also estimated that 15,340 acres of potential ferret habitat (black-tailed prairie dog towns) existed in Converse, Platte, and Laramie counties in 1971. Even though the potential exists for the occurrence of a black-footed ferret in any prairie dog town, the probability of such an occurrence is extremely small. However, until ground surveys are conducted to determine the absence or presence of black-footed ferrets in these towns, a tentative "may affect" conclusion must be made.

There are no known bald eagle nests on winter roosts in counties which would be traversed by the proposed pipeline corridor. However, wintering bald eagles could be encountered along most of the pipeline corridor, especially at the North Platte and Laramie river crossings.

Construction could affect the bald eagle in two ways: removal of perch trees at river crossings, and displacement of individual bald eagles from the construction area.

The removal of perch trees represents a localized impact which, if other suitable perch trees exist in the affected area, would be insignificant. If construction removed the only perch tree in the vicinity of the proposed crossing, the impact would be locally significant. However, such an isolated case is highly unlikely. Displacement of individual eagles would be significant only if other available habitat is lacking. Displaced individuals would most likely settle on another river reach until construction was completed.

Peregrine falcon nesting habitat is lacking in the portions of Converse, Platte, and Laramie counties, Wyoming, and Weld County, Colorado, which would be traversed by the product pipeline (Wyoming Game and Fish Department 1980a). Significant impacts are not anticipated.

Construction of the proposed product pipeline could directly affect populations of two status review plant taxa: the persistent sepal yellowcress and the Colorado butterfly-weed. Surveys planned for August 1981 will determine whether either of these two plants occurs in the proposed pipeline corridor. Construction of the pipeline could directly affect both plants. The most severe impacts would result from direct removal of individuals or populations in the corridor. Removal of individuals or populations is considered a locally significant impact; the effect on regional populations is questionable at the present time.

Operation, Maintenance, and Abandonment

No significant impacts to threatened, endangered, or status review species are anticipated from operation, maintenance, and abandonment of the proposed product pipeline.

3.G NONROUTINE OPERATIONS

Included in this section are potential biological impacts associated with spills of coal, ash, sulfur, and ammonia; water supply system well field malfunctions and water pipeline ruptures; Combs Reservoir dam failure; and ruptures of the product pipeline. The probability of any of the impacts described below is extremely remote, and these "accidents" do not represent normal operation or maintenance procedures.

3.G.1 VEGETATION

The potential exists for a water well malfunction and/or a water pipeline rupture that would result in the discharge of water at or near the ground surface. Such a release of water could directly affect vegetation. Depending on the amount of water released, the effects on vegetation could be restricted to the immediate area of the spill or could be more extensive and include as much as 1 acre. The water released would be relatively hot (60°C/140°F), and it is anticipated that vegetation in the affected area would be destroyed. The loss would be localized, and probably less than one acre would be affected. It is most likely that prairie grassland vegetation would be affected by a spill; however, the potential exists for a rupture in riparian or wetland vegetation (along Little Box Elder or La Prele Creek). Localized losses of prairie grassland vegetation are expected to be insignificant. On the other hand, loss of additional riparian

or wetland habitat would represent a significant although localized impact.

Additional surface disturbances would be required to repair a rupture in a water pipeline; however, it is anticipated that the amount of surface disturbance would be small (probably less than 0.5 acre) and insignificant.

A rupture of the product pipeline would result in releases of methane, hydrogen, argon, nitrogen, carbon dioxide, and carbon monoxide. Vegetation above the rupture would be destroyed, and the area affected would be, most likely, less than 1 acre around the rupture point. Additional surface disturbances would be required to repair the ruptured line (probably less than 0.5 acre). If the rupture occurred in prairie grassland vegetation, insignificant impacts are anticipated to occur. If wetlands or riparian vegetation were affected, the impact would be significant although localized.

Rail cars have been proposed to transport sulfur and ammonia from the gasification plant to a commercial buyer. If an accidental spill of the sulfur or ammonia occurred, vegetation near the spill site could be covered. Although it is impossible to predict the area affected, 1 acre probably represents a worst case. The significance of the effects would depend primarily on the quantity spilled and the spill location. It is anticipated that in most cases prairie grassland vegetation would be affected and that the impacts would be insignificant and localized. Vegetation effects would be most severe during cleanup.

The electric railroad would be used to transport coal from the Rochelle Mine to the gasification plant. In addition, coal ash would be transported from the plant to the mine for burial. Consequently,

the potential exists for hopper car spills of coal and/or ash onto the terrestrial environment along the railroad corridor. Hopper car spills would cover vegetation in a relatively small area; most likely less than 1 acre would be covered. Additional acres could be disturbed during cleanup procedures. Over most of the route, potential spills would occur on prairie grassland vegetation or on agricultural lands. The impact, although locally severe, would be insignificant in terms of the relative amount of regional prairie grassland affected (see Section 3.D). If hopper cars spilled at the Antelope Creek crossing, riparian vegetation would be affected. As explained throughout this document, any loss of riparian vegetation represents a significant impact. Cleanup in the riparian zone could further affect components of the riparian community (i.e., large trees) which may not be directly affected by the spill.

The final nonroutine impact addressed in this section is the possible failure of the Combs Reservoir dam. Failure of the dam would result in temporary inundation of prairie grassland, dry stream bottom, and potentially some riparian vegetation (along the north shoreline of the North Platte River). Additional impacts would result from severe erosion, which would result from the release of the large volumes of water stored behind the dam.

3.G.2 TERRESTRIAL WILDLIFE

The component of the terrestrial wildlife fauna which would be most susceptible to impacts from nonroutine spills and ruptures are small mammals, amphibians, and reptiles. Generally, these animals have small home ranges and tend to retreat to burrows when disturbed. More mobile species (i.e., big game, predators, and birds) would be able to escape most effects from nonroutine operation.

Water pipeline ruptures or well malfunctions could cause small amounts of terrestrial wildlife habitat (probably 1 acre or less) to be inundated. Although some small mammals, amphibians, and reptiles on the periphery of the impact area would escape direct mortality, it is questionable whether new home ranges could be established due to competitive stress. Most likely, these individuals would be lost to predators. Those animals within the impact area which managed to escape the effects of the rupture or malfunction would probably be lost during surface disturbances necessary for repair. The loss of these individuals, although locally severe, would be regionally insignificant. Small mammals, amphibians, and reptiles would be expected to quickly reinvade the area once habitat was again suitable.

Similar impacts would be expected from a product pipeline rupture. The loss of vegetative habitat would cause displacement of small mammals, amphibians, and reptiles in the affected area. Additional surface disturbances would also affect the remaining individuals in the area of impact. Recolonization would be rapid once habitat was again suitable.

Spills of coal or ash from hopper cars along the railroad corridor would also eliminate populations of small mammals, amphibians, and reptiles in the spill area. Although locally severe, the impacts on regional population levels would be negligible.

A dam failure at Combs Reservoir could have more severe effects on small animal populations. If a major rupture occurred, the entire mammal, amphibian, and reptile populations in the path of the escaping water could be lost. The impacts to small animals would be locally severe, although regionally insignificant.

3.G.3 AQUATIC BIOLOGY

A water well malfunction and/or water pipeline rupture could occur at either well field or along the water pipeline routes. Well water temperature has been estimated at 60°C (140°F). This temperature is well above acceptable criteria for short-term exposure (U.S. Environmental Protection Agency 1976a). If a rupture occurred, the affected area and severity of the resultant impact would be primarily dependent upon ambient water temperature, volume, and temperature of water spilled, presence and/or volume of water in stream, and indigenous fish species present. If a pipeline ruptured during a period when no water was present, fishes would not be affected. However, eggs, larvae, and adult aquatic invertebrates could be present in the deeper sediments. Temperatures of 60°C or higher could potentially kill these organisms, and a subsequent decrease in the benthic standing crop would be expected.

If a pipeline ruptured during a period of flowing water, a significant, localized, short-term impact could result. The worst case impact would occur if the rupture took place during spring spawning. A large number of adult fish and offspring could be affected. Benthos would be affected more severely than fishes. Where possible, fish would be expected to leave the affected area, while most benthos would not be able to escape the effect. The area that would be most severely affected would include stream reaches where the change in water temperature exceeded 3°C. Heat shock studies have generally indicated that instantaneous fish mortality declines as rapid temperature change is limited to approximately 3°C or less (Talmage and Coutant 1978; Environmental Protection Agency 1976a).

It would be anticipated that pipeline breaks would release large amounts of water in relatively short periods of time. If a spill

occurred at a stream crossing that did not contain water, the impact is anticipated to be negligible. Scouring of sediments would occur, but the absence of the aquatic biota would limit the impact. If water were flowing, it is be anticipated that the impacts would be similar to that from a severe rainstorm. Increase in flow would cause an increase in turbidity, drift of invertebrates, and could carry eggs and benthic invertebrates downstream. A short-term decrease in population density would be anticipated, but no significant long-term impacts would be anticipated.

A small reservoir would be traversed by gathering lines in the proposed North Well Field. The reservoir has not been surveyed by the Wyoming Game and Fish Department, but nongame forage fish are probably present (McKnight 1981). A pipeline rupture in this reservoir could increase the temperature significantly. A rapid increase in water temperature (3°C above ambient) has been reported to result in fish mortality (Talmage and Coutant 1978; Environmental Protection Agency 1976a). If the water temperature increased more than 3°C, a fish kill could result. A significant short-term impact would be expected if a pipeline ruptured in or near this reservoir.

La Prele and Little Box Elder creeks, and other intermittent streams associated with the South Well Field and water pipe line could be significantly affected by a pipeline rupture, as described above for North Well Field streams. Since La Prele and Little Box Elder creeks maintain trout fisheries, fish and invertebrate kills as a result of thermal shock would be significant although localized. With stocking efforts it would be anticipated that the stream biota could recover in less than 5 years.

Three existing gully-plug reservoirs are in close proximity to gathering lines in the South Well Field. If a water pipeline rupture

occurred in the vicinity of these reservoirs, significant impacts could result. The reservoir on Little Box Elder Creek is used as a brood reservoir for Eagle Lake strain rainbow trout by the Wyoming Game and Fish Department (McKnight 1981). A rapid change in the temperature of the reservoir could potentially reduce the adequacy of this reservoir for producing good stock. The remaining reservoirs have not been surveyed by the Wyoming Game and Fish Department, but it is anticipated that nongame fish are present (McKnight 1981). After temperatures of the reservoirs returned to normal, fish could be restocked and invertebrates would recolonize. It is anticipated that a significant short-term impact could result from a pipeline rupture which increased the temperature in the reservoir above 3°C.

The potential exists for a gathering line rupture to disturb wetland habitat directly downstream from the proposed Little Box Elder Creek crossing. Introduction of heated waters to wetlands would have varying impacts, depending on the type and size of wetlands and time of year of introduction. Ponds or marshes would contain the water, absorbing the heat within a definite area. A primary factor in determining the severity of impacts to wetlands is the amount of water discharged compared with the amount of water in the wetland--a small discharge into a large wetland would have the least impact, while a large discharge into a small wetland could have a large impact. Another moderating factor would be time of year, since winter temperatures, particularly with wind present, could quickly reduce the spill temperature.

It should be noted that all discussions of aquatic biological impacts anticipated as a result of well water supply system failure represent a worst-case analysis. It would generally be expected that a system failure would be discovered in a relatively short period of time, thus limiting the volume of water actually lost.

Water quality characteristics of the North and South well field water are not well known. Heavy metal determinations have not been made, and the quality of the water would be expected to change over the life of the project. It is not possible, therefore, to determine whether or not significant aquatic biological impacts would be anticipated as a result of chemical water quality stress induced by a water supply system failure.

The potential rupture of the product pipeline in a body of water would be expected to result in insignificant aquatic biological impacts. The product gas would contain 95 percent (by volume) methane. Hydrogen, argon, nitrogen, carbon dioxide and carbon monoxide are the remaining constituents. Methane is highly insoluble in water and would probably escape to the air soon after pipeline rupture. The limited time that the gas would be in the aquatic habitat would limit the impact. Due to physical disturbance, fish would probably leave the affected area, but no physiological damage would be anticipated. It is anticipated that rupture of a pipeline in the terrestrial environment would have little or no impact on the aquatic environment.

It has been proposed that rail cars would transport ammonia from the gasification plant to a commercial buyer. If an ammonia cargo were spilled near or in a stream, a fish and invertebrate kill would be expected to occur. The U.S. Environmental Protection Agency (1976) has reviewed the toxicity of ammonia to aquatic organisms. Toxicity was attributed to undissociated ammonia (NH_3). Toxicity has been found to be dependent upon the concentration of total ammonia, pH, temperature, and ionic strength; Table 3-6 presents the relationship of temperature and pH with un-ionized ammonia (NH_3). Highly alkaline waters have the highest levels of NH_3 fractions; most of the project area waters have a neutral pH. Lethal concentrations for fishes ranged from 0.2 to 2.0 mg/l NH_3, with trout being the most

Table 3-6

PERCENT UN-IONIZED AMMONIA IN AQUEOUS AMMONIA SOLUTIONS

Temperature (°C)	pH 6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	0.013	0.040	0.12	0.39	1.2	3.8	11.	28.	56.
10	0.019	0.059	0.19	0.59	1.8	5.6	16.	37.	65.
15	0.027	0.087	0.27	0.86	2.7	8.0	21.	46.	73.
20	0.040	0.13	0.40	1.2	3.8	11.	28.	56.	80.
25	0.057	0.18	0.57	1.8	5.4	15.	36.	64.	85.
30	0.080	0.25	0.80	2.5	7.5	20.	45.	72.	89.

Source: Thurston et al. (1974) as reported in U.S. Environmental Protection Agency (1976a).

sensitive and carp the most resistant of the fish tested. At less than lethal levels (0.002 mg/l NH_3), gill hyperplasia was reported in fingerling chinook salmon. Pathological effects on liver and blood have been reported from various fish species at a concentration of 0.27 mg/l NH_3. Carp were exposed to sublethal NH_3 concentrations and exhibited extensive necrotic changes and tissue disintegration in various organs. Although levels of NH_3 increase as temperature increases, toxic effects of NH_3 versus temperature are unknown. The criterion for freshwater aquatic life was reported by the U.S. Environmental Protection Agency (1976a) as 0.2 mg/l NH_3.

It would be anticipated that if a spill occurred in a stream with flowing water a localized fish kill would occur. The magnitude of the kill would be dependent upon volume of ammonia, species, volume and temperature of water in the stream, among other factors.

It has been proposed that sulfur, a by-product of the gasification project, would be collected in sufficient quantities to be available for commercial uses. It is assumed that the sulfur would be transported by rail cars. A spill of sulfur in or near a stream would probably not have a deleterious chemical effect. In a stream that contained flowing water, sulfur would probably float downstream, since it is not easily soluble in water, and would coat the banks. The impact would probably not be significant to the aquatic biota, although fishes would probably temporarily emigrate from the affected area.

The potential for hopper car coal spills into streams exists, although it should be noted that the proposed rail route crosses intermittent streams only. If such spills occurred during dry streambed conditions, no significant impact on aquatic biota would be anticipated, since the spilled coal could be recovered before streamflow

dispersed it and since no fishes or epibenthic invertebrates would be present.

If a spill occurred during flowing-water periods, biological impacts would be expected to be locally significant and short term. A single-car (100 tons) spill would be expected to smother and kill stream-bottom invertebrates and some fishes in at least a 100-square-yard area (Woodward-Clyde Consultants 1980). This would represent a loss of approximately 3 pounds (dry weight) of invertebrates and 0.5 pound (dry weight) of fish flesh that would have been produced from foraging on the affected invertebrate community (see discussion in Section 3.A.3).

The potential for hopper car spills of coal ash into water bodies exists, although such a spill into an intermittent stream during dry streambed conditions would be anticipated to have no significant aquatic biological impacts, for the reasons cited above. Investigations by Cherry et al. (1979), however, indicate that such a spill during flowing-water periods could affect aquatic biota in three major ways: (1) through the physical effects of siltation, (2) ash-induced pH changes, and (3) ash-associated elemental concentrations.

Biological impacts associated with stream siltation are discussed in Section 3.A.3. Ash-induced pH changes constitute stress of the stream system and, depending upon severity, could result in kills or changes in species diversity (U.S. Environmental Protection Agency 1976a; Thurston et al. 1979). Guthrie and Cherry (1979) observed that stream invertebrates actually ingested coal ash from a river bottom; therefore, bioaccumulation of certain elements would be possible.

Leachate studies recently conducted by WyCoalGas on coal ash to be transported to and disposed on the mine site indicated that concentrations of silver, cadmium, and mercury could have toxic effects on aquatic biota if a sufficient quantity were spilled into a slow-flowing stream or a pool. Cadmium concentrations in the disposal mix were reported at less than 0.008 mg/l (8 μg/l). The following values were recommended for cadmium levels in fresh water by the U.S. Environmental Protection Agency (1976a):

- Soft water: 0.4 μg/l for cladocerans and salmonid fishes and 4.0 μg/l for other, less sensitive aquatic life

- Hard water: 1.2 μg/l for cladocerans and salmonid fishes and 12.0 μg/l for other, less sensitive, aquatic life

Cadmium is an extremely dangerous poison primarily because there is progressive, chronic poisoning and almost no excretion of the metal. Ball (1967) found cadmium accumulation relatively slow; a lethal threshold of 0.01 mg/l in fish was not detectable until after 7 days' exposure.

Pickering and Gast (1972) found that a concentration of 57 μg/l cadmium decreased survival of developing fathead minnow embryos. No detectable adverse effect on survival, growth, or reproduction was reported at levels from 4.5 to 37.0 μg/l cadmium. Nine of 18 adult bluegills exposed to 80 μg/l cadmium died, while in the same test bluegills exposed to 31 μg/l survived (Eaton 1974). Although at 80 μg/l cadmium the hatching success of fish eggs was not measurably affected, the survival and growth of larvae were severely reduced after 60 days (U.S. Environmental Protection Agency 1976a). Sixty days after hatching in hard water, growth and survival of juvenile channel catfish were significantly reduced at 17 μg/l cadmium but not

at 12 μg/l (U.S. Evironmental Protection Agency 1976a). Embryos and juvenile brook trout exposed to cadmium concentrations from 0.4 to 100 μg/l in soft water suffered a reduction in standing crop at 12 μg/l (U.S. Environmental Protection Agency 1976a). Zitko (1975) found a LC_{50} at concentrations of 1.4 to 1.9 mg/l cadmium in fathead minnows.

The National Academy of Science (1972) reported that recent exposures of fish eggs and larvae in soft water demonstrated that 0.01 mg/l cadmium was unsafe; 0.004 mg/l was safe for several warm- and cold-water fishes, including some salmonids.

Andersen (1975) determined the 10-day LC_{50} for the midge (<u>Tanytarsus dissimilis</u>) to be 3.4 μg/l in soft water (48 mg/l hardness). A concentration of 3.1 μg/l cadmium retarded growth, and 1.9 μg/l elicited no obvious effect. Biesinger and Christensen (1972) reported that 50 percent of the <u>Daphnia magna</u> exposed to cadmium concentrations of 5 μg/l were killed in 3 weeks. The production of young was reduced by 50 percent, compared with control concentrations of 0.7 μg/l. Rehwoldt (1973) and others have reported that several invertebrate species are less sensitive to cadmium in acute tests than in the midge and cladoceran exposures described above.

Salmonids and cladocerans appear to be the most sensitive among organisms tested to date. Increased hardness and/or alkalinity have been reported to decrease the toxicity of cadmium in acute freshwater mortality tests, but may have less of an effect at low levels (U.S. Environmental Protection Agency 1976b). At concentrations of 8 μg/l, cadmium could cause a localized kill of invertebrates. It seems reasonable to expect that fish would not be susceptible to the toxic effects at such a low concentration. Most likely, the spill would

cause a reduction in plankton and benthic densities until the concentration was sufficiently diluted (below 1 μg/l. The effect, although localized, would be biologically significant.

Leaching of selenium from the disposal mix could reach concentrations of 0.044 mg/l (44 μg/l). The U.S. Environmental Protection Agency (1976a) recommends "0.01 of the 96 hours LC_{50} as determined through bioassay using a sensitive resident species" as the criterion for protecting freshwater aquatic life.

Biologically, selenium is essential in trace amounts for animals but toxic when ingested in amounts ranging from 0.01 to 10 mg/kg of food (U.S. Environmental Protection Agency 1976a). A concentration of 2.0 mg/l selenium, as sodium selenite, proved lethal to goldfish in 18 to 46 days (ORSANCO 1950). Bringhamm and Kuhn (1959) demonstrated the threshold effect of selenium on the following organisms:

- <u>Daphnia</u> - 2.5 mg/l in 2 days
- <u>Scendesmas</u> (algae) - 2.5 mg/l in 4 days
- <u>Microregma</u> (protozoan) - 138 mg/l in 4 days

Data regarding the possible effects of selenium in the freshwater environment are seriously lacking. All that can be concluded from the previously mentioned data is that the toxic effect is relatively slow and that concentrations much greater than those reported from the disposal mix are necessary to illicit a short-term toxic effect.

Leachate studies conducted by WyCoalGas revealed that arsenic could reach concentrations of 0.056 mg/l (56 μg/l). The U.S. Environmental Protection Agency (1976a) listed the following criteria for arsenic concentrations:

- 50 μg/l in domestic water supplies
- 100 μg/l for irrigation of crops
- 50 μg/l for aquatic life

Although arsenic is concentrated in most aquatic organisms, it is evidently not progressively concentrated along a food chain (U.S. Environmental Protection Agency 1976a). Arsenic (As) consumed as an organically bound species in flesh has low toxicity (Ferguson and Gavis 1972).

Wilber (1969) reported that 234 mg/l of sodium arsenate was the lethal threshold for minnows at 16 and 20°C. Sorenson (1976) found the following LC_{50} values for sodium arsenate in green sunfish: 100 mg/l for 46 hours; 500 mg/l for 17 hours; 1000 mg/l for 12 hours. Sorenson also reported TL_{50} values for 18 hours (350 mg/l As), 24 hours (175 mg/l As), and 48 hours (150 mg/l As).

Trivalent arsenic is highly toxic to invertebrates (U.S. Environmental Protection Agency 1976a). Conversely, toxicity of pentavalent arsenic is relatively low. Lueschow (1964) concluded that trivalent inorganic arsenic was 10 to 15 times more toxic to the benthic invertebrate Tendipes plumosus than the pentavalent form. Certain invertebrates can withstand concentrations of 1.3 mg/l arsenic (Surber and Meehan 1931). Gilerhus (1966) found that a concentration of 2.3 mg/l in a confined pool reduced the survival and growth of fish, benthic invertebrates, and plankton. Arsenic concentrations, although above the recommended criterion, are not expected to cause toxic effects to fish or invertebrates in the spill area.

Chromium concentrations could reach 0.098 mg/l (98 μg/l), according to a WyCoalGas study. The U.S. Environmental Protection

Agency (1976a) listed 100 μg/l chromium as the maximum acceptable concentration for maintenance of freshwater aquatic life. Concentrations expected from the disposal mix are below this minimum requirement.

Generally, fish appear to be relatively tolerant to chromium, but some aquatic invertebrates are quite sensitive. Pickering and Henderson (1966) obtained 96-hour LC_{50} values for hexavalent chromium ranging from 17.6 mg/l for fathead minnows to 118 mg/l for bluegills in soft water. In hard water, 96-hour LC_{50} values for hexavalent chromium ranged from 27.3 mg/l for fathead minnows to 133 mg/l for bluegills. The U.S. Environmental Protection Agency (1976a) reported that in soft water a 96-hour LC_{50} concentration for brook trout was 59 mg/l. The 96-hour LC_{50} value for rainbow trout in soft water was 69 mg/l chromium, while 0.3 mg/l was considered a safe concentration (U.S. Environmental Protection Agency 1976a). Data provided by Olson (1958) demonstrates a pronounced cumulative toxicity of chromium to rainbow trout (National Academy of Science 1972).

Biesinger and Christensen (1972) reported a 16 percent reproductive impairment in Daphnia magna in soft water at a concentration of 0.33 mg/l of trivalent chromium. Some data are available concerning the toxicity of chromium to algae. The concentrations of chromium that inhibited growth for the test organisms are as follows: Chlorococcales, 3.2 to 6.4 mg/l; Euglenoids, 0.32 to 1.6 mg/l, and diatoms, 0.032 to 0.32 mg/l (Hervey 1949).

The U.S. Environmental Protection Agency (1976a) reported significant effects on fish at 0.2 mg/l of hexavalent chromium and recommended a criterion of 0.1 mg/l to provide adequate protection of both freshwater fishes and invertebrates. At concentrations of 0.098 mg/l, chromium from the coal ash leachate is not expected to be toxic to aquatic biota at the spill site.

Data from WyCoalGas indicate lead concentrations could reach 0.005 mg/l in the coal disposal solid waste mix. The U.S. Environmental Protection Agency (1976a) lists the criterion for lead in fresh water as "0.01 times the 96-hour LC_{50} value for sensitive freshwater species."

Lead is highly toxic to rainbow trout in hard water and soft water (Davies et al. 1976). Davis et al. (1976) reported that two static bioassays in hard water gave 96-hour LC_{50} values of 1.32 and 1.7 mg/l dissolved lead, and 542 and 471 mg/l total lead. In a flow-through bioassay in soft water, a 96-hour LC_{50} value of 1.17 mg/l, expressed as either dissolved or total lead, was obtained. Davies et al. determined that the "maximum acceptable toxicant concentrations" (MATC) for rainbow trout in hard water were between 18.2 and 31.7 µg/l total lead. The MATC values for soft water were between 4.1 and 7.6 µg/l for the egg stage and 7.2 and 14.6 µg/l for the early larval stage. They concluded that rainbow trout were most susceptible to lead poisoning in the egg stage.

Brown (1968) reported a 96-hour LC_{50} at 1 mg/l lead for rainbow trout in soft water. No indication of trout size or whether the LC_{50} was indicative of dissolved or total lead was provided. Pickering and Henderson (1966) found 96-hour LC_{50} values for brook trout and fathead minnows were 4 to 5 mg/l and 5 to 7 mg/l, respectively, in soft water. The 96-hour LC_{50} values in hard water were 482 mg/l (fathead minnow) and 441 mg/l (brook trout).

The National Academy of Science (1972) concluded that there is not sufficient information on chronic toxicity of lead to fish to justify recommending values as application factors. However, preliminary information on long exposures (2 to 3 months) of rainbow trout and

brook trout indicated detrimental effects at 0.10 mg/l of lead in soft water.

Beisinger and Christensen (1972) reported that reproduction in Daphia magna was observed at a concentration of 0.03 mg/l lead. Consequently, the National Academy of Science (1972) recommended the concentration of 0.03 mg/l, the safe level for Daphnia, as the criterion for protection of aquatic life. The National Academy of Science concluded that the 0.03 mg/l lead criterion is probably also close to the safe level for fish because tests, although somewhat preliminary, indicated that concentrations about 2 or 3 times higher had detrimental effects. Lead leachate from a possible aquatic spill would result in concentrations well below those known to be toxic to aquatic biota.

Mercury levels in the disposal mix would be less than 0.0002 mg/l (0.2 μg/l). A maximum concentration of 0.05 μg/l mercury was listed by the U.S. Environmental Protection Agency (1976a) for protection of freshwater aquatic life.

Most data about mercury involve the organic compounds. Information is available, however, for inorganic mercury in the form of mercuric ions. Short-term 96-hour bioassay studies indicate that concentrations of 1 mg/l were fatal to fish (Boetius 1960; Jones 1939; Weir and Hine 1970). For long-term exposures of 10 days or more, mercury levels as low as 10 to 20 mg/l were shown to be fatal to fish (Uspenskaya 1946).

The chemical form of methylmercury makes little difference in its toxic effects on fish (Miettinen et al. 1970). The methylmercury bound to sulfhydral groups of proteins, as it would be in streams, is

just as toxic as the free unbound ionic form (National Academy of Science 1972).

Some fish are able to withstand relatively high concentrations of organomercurials for a short time with few detectable ill effects (National Academy of Science 1972). Rucker and Whipple (1951) reported that rainbow trout fry were able to survive 10 μg/l of pyridyl mercuric acetate for 1 hour with no toxic effects. The LC_{50} of pyridyl mercuric acetate for some freshwater fishes ranges from 390 μg/l to 26,000 μg/l for exposures between 24 and 72 hours (Willford 1966; Clemmens and Sneed 1958 and 1959).

As exposure times lengthen, lower concentrations of mercury become lethal. On the basis of 120-hour bioassay tests with three species of minnows, Van Horn and Balch (1955) determined that the minimum lethal concentrations of pyridyl mercuric acetate, pyridyl mercuric chloride, phenyl mercuric acetate, and ethyl mercuric phosphate averaged 250 μg/l.

The National Academy of Science (1972) indicated that 0.02 g/l of methylmercury killed fathead minnows within 6 to 8 weeks. Toxicity data on several other aquatic species including <u>Gammarus</u>, <u>Daphnia</u>, top minnow, and brook trout indicated that none was more sensitive than the fathead minnow. Some species of plankton are particularly sensitive to organic mercury. Studies of the effect of mercury on phytoplankton species revealed that concentrations as low as 0.1 μg/l of selected organomercurial fungicides decreased both the photosynthesis and the growth of laboratory cultures of some freshwater photoplankton species (Harriss et al. 1970).

Concentrations of mercury from the leachate would be sufficient to cause a local fish kill. The toxic effect could also result in a

local decrease in productivity, since concentrations of mercury may be high enough to kill photoplankters.

Finally, anticipated silver levels in the disposal mixture were reported by WyCoalGas to be below 0.002 mg/l. The U.S. Environmental Protection Agency (1976a) recommends "0.01 of the 96-hour LC_{50} as determined through bioassay using a sensitive resident species" as the maximum concentration necessary for protection of freshwater aquatic life.

Davies et al. (1978) reported the mean 96-hour LC_{50} of silver with rainbow trout as 6.5 µg/l in soft water and 13.0 µg/l in hard water. No mortalities could be attributed to silver at concentrations of 0.09 µg/l AG; whereas 17.2 percent mortality occurred at concentrations of 0.17 µg/l. Concentrations of 17 µg/l or greater caused premature hatching of rainbow trout eggs causing a decrease in hatching success and survival.

Coleman and Clearly (1974) found that a 70 µg/l concentration of silver was lethal to bass. Doudoroff and Katz (1953) reported that sticklebacks were killed by a 20 µg/l concentration of silver nitrate in 2 days. Anderson (1944 and 1946) found that the toxic threshold of silver nitrate for <u>Daphnia magna</u> was 3.2 µg/l as silver. These studies (in particular Davies et al.) suggest that the concentrations of silver from the leachate material could result in a local fish and invertebrate kill.

As indicated by the preceding discussion, leaching of silver, mercury, and cadmium from the disposal mix could occur at concentrations sufficient to cause a fish and invertebrate kill. The aquatic community in standing pools would be most susceptible to the toxic effects of a disposal mix spill. Aquatic organisms in this type of

spill scenario would be unable to escape the isolated spill area, and complete mortality would be expected.

In a situation where the spill occurred in flowing water, no toxic effects are anticipated. Although silver, mercury, and cadmium would be leached from the spilled disposal mix at toxic levels, the concentrations would be quickly and continuously diluted.

A spill occurring in the low water flow period would be anticipated to have a localized impact. A single-car (100 tons) spill would be expected to smother and kill bentic invertebrates in at least a 100-square-yard area. This would represent a loss of approximately 3 pounds of invertebrates and 0.5 pound of fish flesh that would have been produced from foraging on the affected invertebrate community (see discussion above). The time necessary for benthic invertebrate recovery from an ash spill would be one to two years in these intermittent drainages.

A spill occurring in the high water flow period would be anticipated to have localized and downstream impacts. The localized impact would be similar to that described for a spill during the low flow period, although less ash would be expected to remain at the spill site. The downstream impact is anticipated to decrease with distance from the spill site and over time. High flow conditions would decrease the severity of long-term downstream impacts through dilution and scouring effects.

If the Combs Reservoir dam failed, the severity of aquatic biological impacts would depend upon the volume of water released over the time period required for the reservoir to drain. In general, however, it would be anticipated that any dam failure allowing more than the equivalent ambient discharge of the North Platte River into the

mainstem would scour invertebrates and some fishes downstream, possibly as far as Glendo Reservoir. The greater the volume of water released, the more severe such impacts would be. Despite the significant biological damage which would be expected during the dam release it is likely that denuded areas of the North Platte would be recolonized from both upstream and downstream areas within two years of dam repair.

The impact of complete dam failure on the Combs Reservoir fishery, if one were established, would be temporary elimination. Recovery of the fishery recovery would be anticipated only after dam repair, reservoir filling, and a concentrated fish stocking program.

Chapter 4
PROJECT ALTERNATIVES

4.A BURLINGTON NORTHERN AND ANTELOPE SPUR RAILROAD

4.A.1 VEGETATION

Construction

The Burlington Northern rail line from the plant site to the junction with the proposed Antelope Spur is complete and operational. Construction necessary for the implementation of this alternative would include a 1-mile section of track across T. 41 N., R. 70 W., sec. 27 and 28. The 1-mile Antelope Spur would permanently remove 24 acres of prairie grassland vegetation.

This alternative would also require the construction of the portion of the proposed action railroad system north of Antelope Creek (including the turnaround loop). Biological impacts associated with construction, operation, maintenance, and abandonment of this section of the proposed action track are described in Section 3.D.

In total, construction of this alternative would permanently remove 121 acres of prairie grassland vegetation. Other vegetation types would not be affected. Significant impacts to vegetation are not anticipated.

Operation, Maintenance, and Abandonment

Fugitive coal dust is expected to increase the area of effect to vegetation from 121 to 242 acres (assuming an additional 100-foot-wide area would be affected by dust on each side of the 200-foot-wide

railroad corridor). The impact on regional prairie grassland vegetation is considered insignificant.

4.A.2 TERRESTRIAL WILDLIFE

Construction

As discussed in Section 3.D., construction of the proposed action railroad corridor (including the turnaround loop) could result in significant localized impacts to mule deer and three golden eagle nests. Construction of the Antelope Spur would not result in additional significant impacts to wildlife species.

Operation, Maintenance, and Abandonment

Operation of this alternative would result in increased traffic on the existing Burlington Northern route. Animal/train collisions are expected to similarly increase. The Burlington Northern route is fenced with sheep-tight wire. This fencing should keep big game species (especially antelope) off the track. Because of the restricted access to the corridor, significant impacts are not anticipated from increased traffic-related train/big game collisions.

Big game species and raptors in the vicinity of the existing corridor have become acclimated to the disturbance associated with existing train traffic. Increased traffic could cause some animals to further avoid the area around the corridor; however, the effect would most likely be insignificant.

No known raptor nests, important big game habitat, or sage grouse leks occur in the vicinity of the Antelope Spur. However, operation of the proposed action railroad corridor north of Antelope Creek would cause significant effects on important mule deer winter habitat in the Porcupine Creek basin and to three golden eagle nests (see Section 3.D).

4.A.3 AQUATIC BIOLOGY

Construction

The Antelope Spur would traverse several intermittent tributaries to Antelope Creek. The proposed action railroad route north of Antelope Creek lies entirely in the Porcupine Creek basin. Both of these drainages are described in Sections 2.A.3 and 2.B.1.

Impacts to aquatic biota from railroad construction activities are discussed in Section 3.A.3. The limited aquatic habitat and biota in this area precludes significant impacts from construction of the railroad.

Operation, Maintenance, and Abandonment

A detailed discussion of the impacts associated with the operation of a railroad on aquatic biota is presented in Section 3.A.3. It is anticipated that no significant impacts would be expected from routine operation, maintenance, and abandonment procedures.

4.A.4 THREATENED AND ENDANGERED SPECIES

Construction

According to the U.S. Forest Service (1979), no prairie dog towns occur on the proposed Antelope Spur. The proposed action railroad corridor, on the other hand, would traverse a prairie dog town at MP 40.5, north of the proposed Antelope Spur junction. Because prairie dog towns provide potential habitat for the federally designated endangered black-footed ferret, a "may affect" situation must be concluded from construction of the railroad alternative until appropriate surveys are conducted.

Operation, Maintenance, and Abandonment

Operation of the railroad alternative, especially the Antelope Spur, could have adverse effects on bald eagles in the area. Antelope Creek is an important wintering area for bald eagles. Disturbances associated with operation of the Antelope Spur could reduce the usefulness of the 1-mile portion of Antelope Creek paralleling the spur. However, because the proposed corridor is nearly 1 mile north of the creek, the effects are anticipated to be regionally insignificant.

4.B ACQUISITION OF PROCESS WATER ENTIRELY FROM LAPRELE RESERVOIR AND THE MADISON FORMATION

4.B.1 CONSTRUCTION

Components necessary for implementation of this alternative are limited to the South Well Field and the water pipeline from the South Well Field to the plant site. The impacts related to construction of these components are described in Section 3.C.

4.B.2 OPERATION, MAINTENANCE, AND ABANDONMÉNT

Similar to the proposed action, operation of the South Well Field would result in a 1-cfs decrease in flow in Box Elder and LaPrele creeks. The effects of a surface flow reduction on aquatic biota in Box Elder Creek are described in Section 3.C. A significant, adverse impact is anticipated. Aquatic resources in LaPrele Creek would be subjected to a significant positive impact. Although pumping from the South Well Field would reduce surface flow in the creek by 1 cfs, increases in water released from LaPrele Reservoir would result in a net increase in flow of 3.2 cfs.

4.C AQUISITION OF PROCESS WATER ENTIRELY FROM THE LANCE, FOX, AND MADISON FORMATIONS

4.C.1 CONSTRUCTION

Implementation of this alternative would require construction of the North and South well fields and their associated pipelines. Construction-related biological impacts for these components are described in Section 3.C.

4.C.2 OPERATION, MAINTENANCE, AND ABANDONMENT

Operation of the South Well Field under this alternative would cause surface flow reductions of 1 cfs in Box Elder and LaPrele creeks. The reduction of 1 cfs in flow in Box Elder Creek is considered a significant, long-term adverse impact. The net increase of 3.2 cfs in LaPrele Creek constitutes a positive significant impact to the stream's aquatic biota (see Section 4.B).

4.D USE OF COAL FINES PRODUCED AT THE MINE FOR PRODUCTION OF ELECTRICITY AT THE PLANT SITE

4.D.1 CONSTRUCTION

Production of electricity at the plant site would require additional construction on the plant site. The acreage disturbed is unknown. As explained in Section 3.B, no significant biological effects are anticipated from construction on the plant site.

4.D.2 OPERATION, MAINTENANCE, AND ABANDONMENT

The production of electricity at the plant site would require an additional 2,000 to 3,000 acre-feet of ground water from the Madison

Formation, resulting in a drawdown of 1.0 to 1.5 cfs in Box Elder and LaPrele creeks. A total drawdown of 2 to 2.5 cfs on each stream would result from combined power plant and gasification plant operations. These reductions would constitute a localized, significant aquatic impact.

Chapter 5
CUMULATIVE IMPACT ANALYSIS

5.A **REGIONAL AFFECTED ENVIRONMENT**

The purpose of a cumulative impact analysis is to determine the effects of all existing and planned regional development on fish and wildlife resources. Assessment of cumulative impacts first requires the identification of regional biological resources. For the assessment to be accurate, the biologist must have available baseline data which indicate the amount and condition of the fish and wildlife resources within the region. For these reasons, the Eastern Powder River Basin was chosen as the region in which cumulative impacts on important wildlife species will be assessed. The one reason for this choice is the availability of data necessary for the assessment.

From June 1978 through May 1979, the Wyoming Game and Fish Department conducted extensive field studies to determine: (1) plant and animal species diversity and density for each vegetation type within the Eastern Powder River Region; (2) the importance of each vegetation type to wildlife in the region; (3) animal species diversity and density on two site-specific study areas; and (4) presence or absence of species federally listed as endangered or threatened, or listed as rare by the state of Wyoming. The objective of this undertaking was to provide biological data which would allow the Bureau of Land Management to assess environmental impacts resulting from coal development in the Eastern Powder River Basin.

The U.S. Bureau of Land Management (1979) used these and other data to evaluate the cumulative wildlife impacts of coal development in the Eastern Powder River Basin. That report, <u>Eastern Powder River</u>

Coal: Final Environmental Statement (U.S. Bureau of Land Management 1979), provides most of the information used in this cumulative wildlife impact assessment for the WyCoalGas project.

The area in which cumulative impacts will be analyzed includes all of Campbell County and the portion of Converse County north of the North Platte River. All of the WyCoalGas project's permanent surface facilities would be located in this region. The area includes approximately 7,780 square miles (4,978,560 acres) of primarily rolling plains, low mountains, rough breaks, and rocky ridges. In addition, aquatic biological analyses will consider the effects of anticipated reductions in the North Platte River discharge as determined by hydrological analyses.

5.A.1 VEGETATION

The Eastern Powder River Basin is a transition zone between the true shortgrass plains to the east and the northern desert shrub type to the west. The vegetation is dominated by low-growing shrubs, herbaceous plants, and grasses with localized patches of both coniferous and deciduous woodlands. The U.S. Bureau of Land Management (1979) has separated the native vegetation in the basin into the eight types listed in Table 5-1.

Each of the eight vegetation types are described briefly below. A more detailed description is provided in the Eastern Powder River Coal: Final Environmental Statement.

Sagebrush-Grass

This type is the most abundant vegetation type in the basin. The shrub layer of the sagebrush-grass community is composed almost

TABLE 5-1
ACREAGES OF VEGETATION TYPES DELINEATED IN THE EASTERN POWDER RIVER BASIN BY THE U.S. BUREAU OF LAND MANAGEMENT

Type	Approximate Acres in Basin	Percentage of Basin Natural Vegetation
Playa grassland	250	<1.0
Scoria grassland	27,300	<1.0
Sandhill grassland	90,100	1.8
Sagebrush-grass	4,188,150	84.1
Silver sagebrush	36,900	<1.0
Greasewood-saltbush	82,960	1.7
Ponderosa pine forest	328,400	6.6
Riparian vegetation	224,500	4.5
Total	4,978,560	

Source: U.S. Bureau of Land Management (1979).

exclusively of big sagebrush. Blue grama is found almost everywhere throughout this community and dominates the understory. Abundant taller grasses include western wheatgrass and needle-and-thread. Less abundant species include Sandberg bluegrass, prairie junegrass, threadleaf sedge, Indian ricegrass, green needlegrass, bluebunch wheatgrass, cheatgrass, and plains pricklypear (U.S. Bureau of Land Management 1979).

Ponderosa Pine Forest

This vegetation type is distributed over the badlands-scoria region north and east of Gillette in Campbell County. It extends southward in a long narrow band to Lusk and then west toward Douglas. Typically, the ponderosa pine forest is limited to the crests of sandstone, shale, and scoria outcrops. The principal tree species is ponderosa pine which grows in stands which range from open savannahlike woodlands to closed-canopy forests. Understory shrubs in denser forest stands include skunkbush sumac, creeping juniper, and western snowberry. Grasses, which dominate the herbaceous layer, include green needlegrass, Sandberg bluegrass, prairie junegrass, and stony hills muhly. In more open stand areas, silver sagebrush, green needlegrass, and sideoats grama dominate the understory (U.S. Bureau of Land Management 1979).

Riparian Vegetation

Only approximately 4.5 percent of the Eastern Powder River Basin is covered with riparian vegetation. This type occurs along drainage and adjacent to lakes, ponds, and springs. Broadleaf trees are present on some of the perennial stream floodplains, including portions of the Cheyenne, Belle Fourche, Powder and Little Powder rivers, and along some intermittent streams in both counties. Trees characteristic of this type include plains cottonwood, lanceleaf

cottonwood, sandbar willow, coyote willow, peachleaf willow, and boxelder. Common forbs are prairie cordgrass, tufted hairgrass, slender wheatgrass, western wheatgrass, inland sedge, baltic rush, arrowgrass, and golden pea (U.S. Bureau of Land Management 1979).

Sandhill Grassland

This type covers a region of both active and stable sand dunes in southwestern Converse County, just north of the North Platte River. The vegetative cover in this region is open grassland with prairie sandreed as the dominant species. Also common are needle-and-thread, Indian ricegrass, blue grama, hairy grama, sand dropseed, and Sandberg bluegrass. In some areas dense stands of silver sagebrush are prominent and small soapweed, fringed sage, and cudweed sagewort may also be locally abundant (U.S. Bureau of Land Management 1979).

Greasewood-Saltbush

This shrub community is present along stream channels and in areas where soils are saline or alkaline. Moderate to heavy stands of black greasewood and scattered rubber rabbitbrush characterize the shrub layer in this community. Other shrub species present include fourwing saltbush, Gardner saltbush, and winterfat. Grasses present include inland saltgrass, squirreltail, alkali saltgrass and alkali sacaton (U.S. Bureau of Land Management 1979).

Playa Grassland

Playas are seasonally inundated, level to gently sloping areas characterized by deep, poorly drained, very clayey soils. A very distinct grassland community, dominated by western wheatgrass, occurs on the playa sites. Subordinate species on these sites are dependent upon the length and degree of inundation. Where surface waters evaporate quickly and the water table drops, foxtail barley is typically the only other plant species present. Where the duration of

standing water is longer, slender spike rush occurs as a codominant with western wheatgrass (U.S. Bureau of Land Management 1979).

Scoria Grassland

This community typically occurs on relatively rough, steep slopes, and sandy to gravelly loam soils with low water-holding capacity. Blue grama is usually the dominant plant taxa. Other grasses and shrubs include little bluestem, prairie sandreed, sand dropseed, Indian ricegrass, globemallow, lupine, small soapweed, big sagebrush, and skunkbush sumac (U.S. Bureau of Land Management 1979).

Silver Sagebrush

This community is most common on level to sloping floodplains but is widespread throughout the region and can occur under many conditions. Soils at these sites are usually deep, well drained and somewhat sandy or loamy. Silver sagebrush dominates the shrub and may form thick stands. Understory grasses include western wheatgrass, needle-and-thread, Sandberg bluegrass, mat muhly, blue grama, prairie junegrass, and threadleaf sedge. Forbs are typically scarce and occasionally, snowberry shrubs are present (U.S. Bureau of Land Management 1979).

5.A.2 TERRESTRIAL WILDLIFE

Complete lists of wildlife species occurring in the Eastern Powder River Basin can be found in the Eastern Powder River Coal: Final Environmental Statement (U.S. Bureau of Land Management 1979) and are not repeated in this report.

Big Game

Four big game species (pronghorn antelope, mule deer, white-tailed deer, and elk) occur in the Eastern Powder River Basin.

According to the Wyoming Game and Fish Department (as reported in U.S. Bureau of Land Management 1979), 48,000 antelope occupied the Eastern Powder River Basin in 1979, and a projected decrease in the number by 7.9 percent (to 44,200 animals) is expected by 1983. Table 5-2 lists the average density of antelope and deer in the basin by herd unit.

Similar to the antelope, the Eastern Powder River Basin mule deer population is expected to decrease 3.1 percent from the estimated 30,000 animals present in 1979 to 29,070 by 1983 (U.S. Bureau of Land Management 1979).

Elk in the region are restricted to a small herd (200 animals) in the Fortification Creek area of western Campbell County and eastern Johnson County. At the present time, the area is not proposed for mining although secondary impacts from increased human presence in the region may directly affect this area. White-tailed deer in the basin occur along most of the major drainages. Their range closely corresponds to riparian areas (U.S. Bureau of Land Management 1979).

<u>Upland Game Birds</u>

The sage grouse is the most important game bird in the Eastern Powder River Basin. Sage grouse are restricted primarily to sagebrush vegetation. The Wyoming Game and Fish Department estimated between 0.05 and 0.08 sage grouse/acre in this type (Table 5-3). In addition, they reported 27 active leks and 13 inactive leks in Campbell County. Twelve additional leks were reported in Converse County north of the Platte River (Wyoming Game and Fish Department 1980a). Density estimates for other game bird species (turkey, sharp-tailed grouse, and gray partridge) also appear in Table 5-3. These birds are found in scattered populations in the basin or require specialized habitat (U.S. Bureau of Land Management).

TABLE 5-2
AVERAGE NUMBER OF DEER AND ANTELOPE PER SQUARE MILE (ALL HABITAT TYPES COMBINED) IN HERD UNITS IN THE EASTERN POWDER RIVER BASIN

Species / Herd Unit	Mean Number/Square Mile
Antelope	
Powder River Herd Unit	3.0
Pumpkin Butte Herd Unit	6.0
Bear Creek Herd Unit	5.8
Lance Creek Herd Unit	5.1
North Black Hills Herd Unit	4.1
Basin Mean	4.8
Mule Deer	
Pumpkin Butte Herd Unit	2.0
Lance Creek Herd Unit	2.2
Ormsby Herd Unit	2.0
Powder River Herd Unit	6.5
Thunder Basin Herd Unit	3.0
West Bill Herd Unit	2.0
Basin Mean	3.0
White-tailed Deer	
Thunder Basin Herd Unit	0.4
Powder River Herd Unit	1.7
Basin Mean	1.0

Source: U.S. Bureau of Land Management (1979).

TABLE 5-3
DENSITY ESTIMATES OF MAMMALS, BIRDS, AMPHIBIANS AND REPTILES (NUMBERS/ACRE)
BY VEGETATION TYPE FOR THE EASTERN POWER RIVER BASIN

Species	Grasslands	Sagebrush	Pine	Riparian	Saltbush	Wetlands
Mammals						
Small Mammals	7.4-24.4	9.32-52.72	18-32.3	24.9-71.2	6	
Beaver				0.2		
Muskrat						8.4
Mink				.03-0.1		
Coyote (per square mile)		0.3			0.3	
Bobcat (per square mile)		0.7				
Desert cottontail	0.4	0.2			1.4-4.4	
Snowshoe hare			0.4	0.4		
Birds						
Nongame birds	1.36-8.0	2.44-5.1	5.36-12.87	10.37-21.63	1.3	
Raptors	0.005		0.005	0.005	0.005	
Turkey			0.03			
Sharp-tailed grouse		0.01-0.06				
Sage grouse		0.05-0.08				
Gray partridge	0.02-0.1			0.2		
Mourning dove		0.1	0.01-1.2	0.04-0.7		
Amphibians and Reptiles						
Tiger salamander	0-5	0-5		0.1-30		1-200
Plains spadefoot toad	0-10	0-10		0-5		
Great Plains toad	0.01-2	0.01-2		0.01-1		
Rocky Mountain toad	0.02-2	0-1		0.05-10		
Boreal chorus frog				0-70		0-70
Bullfrog						0-20
Leopard frog				0.2		0-20
Northern sagebrush lizard		1-30				
Eastern short-horned lizard	0.1-10	0.1-10	0-1		0.05-5	
Prairie rattlesnake	0.08-0.3	0.06-0.1	0-0.06	0.08-0.3	0-0.06	
Plains hognose snake	0.05-0.2	0.02-0.08		0.05-0.2		
Eastern yellow-bellied racer	0.08-0.3	0.05-0.3	0-0.06	0.1-0.5		
Western smooth green snake	0-0.05		0-0.02	0.005-0.1		
Bullsnake	0.1-0.5	0.05-0.3	0-0.15	0.1-0.5	0-0.1	
Pale milk snake				0-0.1		
Western plains garter snake	0-0.2			0.05-20		
Wandering garter snake	0-0.1			0.05-20		

Source: U.S. Bureau of Land Management (1979).

Raptors

Many species of raptors occur in the Eastern Powder River Basin. The U.S. Bureau of Land Management (1979) suggested that densities of raptors in the region are restricted primarily by the scarcity of adequate nesting areas. Density estimates for all raptors combined are listed by vegetation type in Table 3. The Wyoming Game and Fish Department (1980a) mapped 39 golden eagle nests in the Eastern Powder River basin.

5.A.3 AQUATIC BIOLOGY

Aquatic habitat in the Eastern Powder River Basin consists primarily of 47 scattered livestock reservoirs (covering 406.1 acres) and 224.3 miles of permanent streams, which support mostly nongame fishes (U.S. Bureau of Land Management 1979). Most of the streams in this region are ephemeral or intermittent. The lack of permanent water precludes the presence of a permanent fish fauna. The middle and lower sections of the Powder and Belle Fourche rivers contain the basin's only perennial streams.

Most of the streams in this region are shallow, slow moving and turbid. Water temperature and flows vary greatly due to precipitation and runoff fluctuations. These conditions favor warm water species.

A checklist of the fishes reported in the various drainages is presented in Table 5-4. Most of the nongame fishes in the region are members of the minnow family. Stocked or native populations of trout, bass, bullhead and/or green sunfish are reported in livestock reservoirs and some streams. Keyhole Reservoir on the Belle Fourche River sustains the largest fishery in the Eastern Powder River Basin (U.S. Bureau of Land Management).

TABLE 5-4
CHECKLIST OF THE FISHES IN THE EASTERN POWDER RIVER REGION

Species	Little Powder River Drainage	Powder River Drainage	Belle Fourche River Drainage	Cheyenne River Drainage
SENSITIVE*				
Shovelnose sturgeon (Scaphirhynchus platorynchus)		S		
Goldeye (Hiodon alosoides)	S	S		
Sturgeon chub (Hybopsis gelida)		S		
Silvery minnow (Hybognathus nuchalis)		S		
NONGAME				
Carp (Cyprinus carpio)	S	S	S,P	S
Flathead chub (Hybopsis gracilis)	S	S	S	S
Longnose dace (rhinichthys cataractae)	S	S	S	S
Creek chub (Semotilus atromaculatus)		S	S	
Sand shiner (Notropis stamineus)	S	S	S	S
Fathead minnow (Pimephales promelas)	S	S	S	S
Plains minnow (Hybognathus placitus)	S	S	S	S
Goldfish (Carassius auratus)		S	S	
Brassy minnow (Hybognathus hankinsoni)		S		
River carpsucker (Carpoides carpio)	S	S		
Northern redhorse (Moxostoma macrolepidotum)	S	S	S	
Common white sucker (Catostomus commersoni)	S	S	S	S
Mountain sucker (Catostomus platyrhynchus)	S	S		
Plains killifish (Fundulus zebrinus)				S
GAME				
Black bullhead (Ictalurus melas)	S,P		S,P	P
Stonecat (Notorus flavus)	S	S		
Channel catfish (Ictalurus punctatus)	S	S		
Green sunfish (Lepomis cyanellus)	S,P		S,P	P
Bluegill (Lepomis macrochirus)				P
Largemouth bass (Micropterus salmoides)	P		P	P
Yellow perch (Perca flavescens)			S	
Walleye (Stizostedion vitreum vitreum)			S,P	
Rainbow trout (Salmo gairdneri)			S,P	
Brown trout (Salmo trutta)			S	
Brook trout (Salvelinus fontinalis)	S		S,P	

Source: U.S. Bureau of Land Management (1979).

Note: S = Fish found in streams; P = Fish found in ponds or reservoirs.
*Considered rare in Wyoming (Wyoming Game and Fish 1977b).

5.B ENVIRONMENTAL CONSEQUENCES

5.B.1 VEGETATION

Table 5-5 lists the anticipated cumulative losses of each vegetation type in the Eastern Powder River Basin by 1990. Projects considered include coal mining, uranium mining, oil and gas activity, sand, gravel and scoria extraction, access roads, railroads, powerlines, power plants and the WyCoalGas project. These data were taken from the Eastern Powder River Coal: Final Environmental Statement (U.S. Bureau of Land Management 1979). As illustrated in Table 5-5, some vegetation types will suffer more severe losses, while other types would be subjected to only minor disturbances.

These estimates suggest that the scoria grassland would be the most severely affected type (5.2 percent) by 1990. Throughout this document, we have generally used a 5 percent reduction to represent a significant regional effect. Using that criterion, the U.S. Bureau of Land Management's (1979) estimate indicates that scoria grassland vegetation in the Eastern Powder River Basin would be subjected to a significant reduction by 1990. Also, the reduction would most likely represent a permanent impact since areas previously covered with the scoria type would most likely be leveled and seeded with grasses during reclamation procedures. Consequently, the original scoria grassland acreages would be lost from the region. Of the projected 1,406-acre scoria grassland loss, 1,348 acres would be lost at the Rochelle Mine.

The silver sagebrush type would be subjected to a 3.6 percent decrease in the Eastern Powder River Basin by 1990. Although this is less than the 5.0 percent significance criterion, the reduction is

TABLE 5-5
CUMULATIVE LOSSES OF VEGETATION, UNDER THE PROBABLE LEVEL OF DEVELOPMENT[1], BY ALL ACTIVITIES IN THE EASTERN POWDER RIVER BASIN

Anticipated Level of Regional Development	Sagebrush-Grass	Scoria Grassland	Silver Sagebrush	Greasewood-Saltbush	Ponderosa Pine	Riparian	All Others Combined	Total[2] Acres
1980 Total (Acres)	21,904	634	625	192	87	454	178	24,074
1985 Total (Acres)	42,320	1,061	1,018	321	146	786	279	45,931
1990 Total (Acres)	54,733	1,406	1,336	425	194	1,030	279	59,403
Estimated acres in basin (1979)	4,188,150	27,300	36,900	82,960	328,400	224,500	90,350	3,978,560
Total projected loss by 1990	54,733	1,406	1,336	425	194	1,030	279	59,403
Percentage of type lost[3]	1.3	5.2	3.6	0.5	<0.1	0.5	0.3	1.2

Source: U.S. Bureau of Land Management (1979).

[1]Projects considered include coal mining, uranium mining, oil and gas activity, sand, gravel and scoria extraction, access roads, railroads, powerlines, power plants, and WyCoalGas' gasification plant.

[2]Acres lost do not include projected disturbances from population increases. The U.S. Bureau of Land Management (1979) estimated the acreage to be 519 in 1980, 2,640 by 1985, and 3,242 by 1990.

[3]Total projected loss by 1990 ÷ estimated acres in basin (1979).

still regionally substantial. Similarly, the loss would most likely be permanent since the topography would be leveled during reclamation.

Any loss of riparian vegetation is considered significant. By 1990 riparian vegetation in the Eastern Powder River Basin would be reduced by approximately 0.5 percent (1,030 acres). Although this reduction is small, the value of this type in terms of wildlife habitat and regional plant diversity makes the effect significant.

All other vegetation types in the region would suffer losses of less than 1.3 percent. Significant regional impacts are not anticipated to these types.

5.B.2 TERRESTRIAL WILDLIFE

Big Game

Estimated direct population losses of pronghorn antelope, mule deer and white-tailed deer due to development in the Eastern Powder River Basin are listed in Table 5-6. Direct impacts would be restricted to mule deer and antelope. Projected direct losses of white-tailed deer and elk are anticipated to be minimal. The losses of progeny are estimated on Table 5-7.

Antelope losses in the basin, including progeny, due to development by 1990 are estimated at 955 animals. This loss would decrease the basin's carrying capacity (from 44,200 animals) by 2.2 percent. The direct loss of antelope and their progeny due to cumulative development is not in itself a significant reduction. However, the BLM estimated that the loss of antelope to vehicle kills and poaching would increase by 688 animals by 1990 (Table 5-8). Combined, these losses represent 3.7 percent of the basin's antelope

TABLE 5-6
ESTIMATED DIRECT POPULATION LOSSES OF MAMMALS AND BIRDS DUE TO REGIONAL DEVELOPMENT IN THE EASTERN POWDER RIVER BASIN

	1980	1985	1990
Mammals			
Small mammals	750,185	1,486,475	1,919,105
Beaver	90	160	205
Muskrat	0	605	605
Mink	30	50	65
Coyote	115	250	325
Bobcat	5	10	15
Desert cottontail	4,635	9,240	11,915
Snowshoe hare	210	365	480
Pronghorn antelope	180	355	455
Mule deer	105	215	280
White-tailed deer	1	1	2
Birds			
Nongame birds	98,165	192,625	248,975
Raptors	120	240	310
Waterfowl	0	1,910	1,910
Turkey	0	5	5
Sharp-tailed grouse	805	1,610	2,075
Sage grouse	1,500	2,990	3,855
Gray partridge	130	220	290
Mourning dove	2,525	4,980	6,425

Source: U.S. Bureau of Land Management (1979).

TABLE 5-7
ESTIMATED LOSS OF MAMMAL AND BIRD PROGENY DUE TO DEVELOPMENT IN THE EASTERN POWDER RIVER BASIN[1]

Species	1980	1985	1990
Mammals			
Small mammals[2]	949,735	3,864,835	7,484,510
Beaver	100	255	430
Muskrat	0	1,330	1,935
Mink	35	90	155
Coyote	130	460	825
Bobcat	5	15	30
Desert cottontail	5,560	20,330	38,130
Snowshoe hare	250	805	1,535
Pronghorn	200	570	955
Mule deer	115	345	590
White-tailed deer	1	1	3
Birds			
Nongame birds	113,870	377,545	687,170
Raptors	130	370	615
Waterfowl	0	3,170	4,220
Turkey	0	10	15
Sharp-tailed grouse	905	2,815	4,930
Sage grouse	1,690	5,235	9,155
Gray partridge	165	550	1,090
Mourning dove	2,955	10,060	18,440

Source: U.S. Bureau of Land Management (1979).

[1] The estimates of progeny lost was added to the number of animals directly lost to obtain the totals presented in this table.

[2] Estimates include jackrabbits.

Assumptions used by the U.S. Bureau of Land Management (1979):

1. A 50:50 sex ratio of males to females.
2. Average annual fecundity is the same for all habitat types for a given group of animals.
3. No mortality during reproduction.
4. Immigration equals emigration.
5. Habitat is utilized at its carrying capacity.

TABLE 5-8
PROJECTED LOSSES OF BIG GAME SPECIES IN THE EASTERN POWDER RIVER BASIN DUE TO POACHING AND VEHICLE KILLS

	1980	1985	1990
Poaching			
Pronghorn antelope	1,330	1,953	1,969
Mule deer	4,318	6,343	6,393
Vehicle Kills			
Pronghorn antelope	92	149	141
Mule deer	149	232	223
Total			
Pronghorn antelope	1,422	2,012	2,110
Mule deer	4,467	6,575	6,616

Source: U.S. Bureau of Land Management (1979).

herd.

In addition to the direct habitat losses and indirect mortality due to poaching and vehicle kills, habitat would be indirectly affected on adjacent areas by human activity, noise and fences. Presently, a long narrow band (along the eastern edge of the coal seam) is being developed from approximately 10 miles north and 55 miles south of Gillette. By 1990 this disturbance would be nearly complete and 2 to 5 miles wide (U.S. Bureau of Land Management 1979). The developed area would split much of the basin's range in half and severely restrict east-west movement to preferred seasonal habitat areas. As a result, undisturbed habitat within the band of disturbance would become useless to big game species. Similar disturbances would probably reduce the basin's antelope herd by twice the 3.7 percent estimated above. Consequently, the reduction in antelope due to regional development is anticipated to be significant.

Direct impacts to mule deer and their progeny are estimated to be equally severe with a 2 percent reduction by 1990 (Table 5-7). However, the U.S. Bureau of Land Management (1979) calculated that poaching and vehicle kills would increase by 2,149 animals (Table 5-8). Including 1990 estimated progeny and direct losses, the basin's mule deer herd would be reduced by 9.4 percent. Similarly, the reduction in the basin's mule deer herd is expected to be significant.

The loss of mule deer and antelope to poaching and vehicle kills is presently a serious problem in the basin. For instance, in 1980 nearly 15 percent of the mule deer in the basin were lost to poaching or vehicle kills. Approximately 3 percent of the basin's antelope herd was similarly lost. By 1990 antelope and mule deer indirect

losses would increase by roughly 33 percent (Table 5-8).

Upland Game Birds

The U.S. Bureau of Land Management (1979) estimated a direct loss of 3,855 sage grouse by 1990 as a result of development in the Eastern Powder River Basin (Table 5-6). That number was obtained by multiplying the average density (0.065/acre) times the estimated sagebrush habitat disturbed (59,311 acres). The progeny expected to be lost as a result of the direct loss of 3,855 adult birds is 5,300 birds (total loss 9,155 sage grouse by 1990). These estimates represent worst case approximations primarily because the calculations assume all habitat that would be affected is at carrying capacity. In addition to direct losses, the regional population may be further reduced by the projected loss of 3 of the region's leks (Mike McClellan, U.S. Bureau of Land Management, Casper, Wyoming, pers. comm., June 16, 1981). These 3 leks comprise 7.7 percent of the leks in the Eastern Powder River Basin.

It is apparent that the sage grouse population in the Eastern Powder River Basin will continue its downward trend into 1990. The anticipated effects from cumulative development are considered both significant and long term.

Raptors

The U.S. Bureau of Land Management (1979) estimated that 310 raptors (Table 5-6) would be lost directly from cumulative development in the basin by 1990. When progeny losses are added, the projected raptor loss is 615 (Table 5-7). These estimates include all raptor species; estimates for individual species are presently unavailable.

Mike McClellan (U.S. Bureau of Land Management, Casper, Wyoming,

pers. comm., June 16, 1981) reported, however, that 12 golden eagle nests would be lost (or manipulated to avoid destruction) by 1990. These 12 nests represent 30.8 percent of the known golden eagle nests in the Eastern Powder River Basin. Consequently, potential impacts appear severe, at least in the case of the golden eagle.

Some success has been achieved in relocating golden eagle nests from mine sites. The long-term success of these relocations, however, is untested. Even if all 12 nests were successfully relocated away from the areas of disturbance, the projected loss of hunting habitat and significant increases in human activity are still expected to cause adverse impacts to the basin's raptor populations.

5.B.3 AQUATIC BIOLOGY

Aquatic impacts of major concern include decreases in surface water discharge, alterations in water quality, loss of habitat and/or changes in carrying capacity.

Water volume decreases, in both groundwater aquifers and surface waters, have been reported and are anticipated to become more severe with future developments (U.S. Bureau of Land Management 1979). No quantitative data, other than those reported in this document, are available to allow for a precise assessment of the regional impacts on aquatic biota. The U.S. Bureau of Land Management, however, considers this issue to be of substantial concern.

A loss of aquatic habitat and/or associated decreases in fisheries' carrying capacity would be expected to result from proposed regional developments. The U.S. Bureau of Land Management (1979) estimates that 224.3 miles of perennial streams were capable of supporting fish in the basin in 1979. The agency estimates that 80

miles of permanent streams in addition to wet potholes, would sustain long-term impacts. Overall, approximately 36 percent of the available stream habitat in the region would be adversely affected. Additionally, an estimated 440 acres of "point-water sources" (ponds, flowing wells, springs, playas, and lakes) would be affected by all activities, and between 620 and 2,000 square miles of drainage areas would be "intercepted" by all activities (U.S. Bureau of Land Management 1979).

The loss of habitat would result in decreased macroinvertebrate and fish population densities. Utilizing only the loss of 80 miles of perennial streams and/or potholes and assuming a mean invertebrate dry weight biomass of 0.5 oz/yd^2 and a 15 percent efficiency for fish to convert food to flesh, a rough estimate of the potential losses in biomass can be produced (Table 5-9). A detailed explanation of the assumptions used for these calculations is included in Section 3.A.3. It is important to note that the potential biomass losses identified only account for perennial stream impacts. Quantitative estimates of impact in intermittent drainages, reservoirs, ponds, springs, and lakes are not presented due to a lack of applicable data.

The U.S. Bureau of Land Management (1979) indicates that the rainbow trout fishery of Caballo Reservoir, and the largemouth bass fishery in Reno Reservoir No. 1 would be lost due to mining activity.

Streams indirectly affected by mining activities would also be expected to sustain a decrease in carrying capacity. In particular, Little Thunder, Caballo, and Rawhide creeks would sustain "...increased siltation, leaching of toxic materials from exposed overburden, and possible sewage (contamination)..." (U.S. Bureau of Land Management 1979). The U.S. Bureau of Land Management also cautioned that many years would be required for ecosystem recovery

Table 5-9
MAXIMUM ESTIMATES OF MACROINVERTEBRATE AND EQUIVALENT FISH FLESH BIOMASS WHICH MAY BE LOST ANNUALLY AS A RESULT OF CUMULATIVE REGIONAL DEVELOPMENTS

Stream Width (feet)	Disturbed Area (sq yd)	Macroinvertebrate Biomass (lb dry weight)	Fish Biomass (lb dry weight)
10	469,286	14,665	2,200
20	938,572	29,330	4,400
30	1,407,858	43,995	6,600
50	2,346,430	73,325	10,999
100	4,692,864	146,652	21,998

Source: U.S. Bureau of Land Management (1979).

Note: See text for discussion of assumptions.

after habitat reclamation, and that there is no guarantee that "similar" biological communities could be reestablished.

Heavy metal watershed contamination could occur as a result of regional developments. Table 5-10 presents concentrations of some heavy metals presently found in the area, coal and overburden leachate, and the maximum concentration for protection of water uses. If leachate and/or mine effluents are allowed to enter watersheds, heavy metals pose a long-term threat to aquatic biota. The U.S. Bureau of Land Management (1979) noted that reclamation efforts must attempt to trap all leachate and intercept flows from the drainages in the mine areas.

A significant, long-term impact on aquatic habitat and extant biota is expected from regional development. Approximately 36 percent of the perennial streams and pothole habitat would be lost (U.S. Bureau of Land Management 1979). Standing water losses are not estimated but also represent a potentially significant, long-term impact. Habitat degradation would also decrease the carrying capacity of streams and standing waters not directly affected by mining activities. A change in species composition would also be expected to favor nongame fish species. Heavy metals, nonpoint source pollutants, and decreases in water volume in the mining areas may affect aquatic biota, but data are not available to quantify these impacts.

TABLE 5-10. COMPARISON OF MAXIMUM HEAVY METAL CONCENTRATIONS IN SURFACE WATERS IN THE LITTLE POWDER, CHEYENNE, AND BELLE FOURCHE RIVERS; BLACK THUNDER MINE LEACHATES; SOILS AND SAGEBRUSH SAMPLES THROUGHOUT THE REGION; AND RECOMMENDED MAXIMUM CONCENTRATIONS FOR PROTECTION OF VARIOUS WATER USES

	Maximum Observed Concentration (ppb)[a]					Recommended Maximum Concentration for Protection of Water Uses (ppb)[a,c]				
Heavy Metal	Surface Water[k] Total	Surface Water[k] Dissolved	Coal & Overburden Leachates[b] Black Thunder Mine	Soil[c]	Sagebrush[c]	Irrigation[d] (continuous use)	Irrigation[d] (20-year use)	Livestock	Public Water Supplies	Aquatic Biota
Arsenic	55	3	90	—	—	100	2,000	200	100	1,000
Beryllium	10	10	120	1,500	—	100	500	e	f	f
Cadmium	20	3	400	30,000	—	10	50	50	10	3[g]
Copper	140	5	320	50,000	—	200	5,000	500	1,000	15[h]
Lead	200	4	10	100,000	150,000	5,000	10,000	100	10	30
Mercury	0.8	0.2	1	40	—	f	f	10	2	0.05[i]
Molybdenum	14	16	23	20,000	30,000	10	50[j]	f	f	f
Selenium	7	7	21	—	4,800	20	20[j]	50	10	f

Source: U.S. Bureau of Land Management (1979).

[a] Parts per billion or micrograms per liter.

[b] Source: University of Wyoming, Black Thunder Project Research Team 1976.

[c] Source: Conner, Keith, and Anderson 1976.

[d] Based on irrigation rate of 3 acre-feet/acre/year.

[e] Because of inadequate data, no maximum water quality criterion was recommended for beryllium; however, a daily dosage of 18 mg/kg body weight apparently had no adverse effects on laboratory rats.

[f] No recommendation given.

[g] Recommend 3 ppb in hard water and 0.4 ppb in soft water.

[h] No recommendation given, but 15-33 ppb appears to be safe for reproduction by fathead minnows in hard water.

[i] No recommendation for total inorganic mercury but recommend no more than 0.05 ppb average total mercury (inorganic plus organic) and 0.2 ppb total mercury at any time or place.

[j] Based on toxicity of forage to livestock rather than phytotoxicity.

[k] Source: Reports of the U.S. Geological Survey.

Chapter 6
GLOSSARY

Acre-foot - the volume of water that would cover one acre to a depth of one foot, equivalent to 43,560 cubic feet. One cubic foot per second (cfs), flowing for 24 hours, is equivalent to 1.983 acre-feet.

Aquifer - one or more formations that contain sufficient permeable material to yield significant quantities of water to wells and springs.

Authorizing action - granting of a permit, easement, license, or similar legal privilege that is needed before a proposed project can proceed.

Backfill - earth that is replaced after a construction excavation.

Base flow - that part of a stream flow derived from ground water.

Baseline - air quality, water quality, or meteorological data used as a starting point in estimating the impact of new emissions.

Basin - a general term for a depressed or concave, downward, sediment-filled area.

Benthic macroinvertebrate - an animal that can be seen with the naked eye, that does not have a backbone, and lives in or on the bottom of a body of water.

Biological diversity - the variety of plants or animals; the more diverse a system is, the more kinds of plants and/or animals it contains.

Biological production - the quantity of organic matter produced by a living system (i.e., by an organism, a group of organisms, or an ecosystem). Two types of production are recognized: Primary production is the quantity of organic matter produced by green plants through photosynthesis; secondary production is the quantity of animal material produced.

Biological productivity - the rate of production of organic matter by living organisms (i.e., the amount per unit time).

Biota - the plant and animal life in an area.

Blanketing - covering an area to be blasted with heavy mats to reduce the extent of flying debris from the blasting.

Blue-green algae - microscopic aquatic plants that belong to the phylum Cyanophyta.

Caddisfly - the adults are slender insects with four wings, sometimes with hairlike scales which give them a mothlike appearance. The larvae live in water and often build cases of sand, small pebbles, leaves, etc.

Coating - a field operation for preparing a pipeline to be lowered into the ditch. The line is coated with an inert material, then spiral-wrapped with a tough, inert wrapper. Machines ride the pipe, and coat and wrap in one continuous operation. This process protects the pipeline from corrosion. For some pipeline jobs, the pipe may be coated and wrapped at a mill or construction yard site. Any damage to the coating from transportation or handling can be corrected before the pipe is installed.

Concentration - the relative content of a component (as dissolved or dispersed material), measured by weight or volume of material per unit volume of the medium.

Copepod - small aquatic crustaceans.

Critical habitat - habitat essential to the conservation of an endangered or threatened species.

Crustacean - invertebrate (animals without backbones) with body divided into two sections, two pairs of antennae, often have jointed appendages and often have gills. Crayfish, prawn, and river shrimp are common forms.

Diatom - microscopic aquatic plants that belong to the phylum Bacillariophyta.

Ecotone - blurred, indefinite transition area between two communities.

Emission - A substance, whether gaseous or particulate, released by human activity into the air or water.

Endemic - restricted to a particular geographical area.

Ephemeral stream - a stream that flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and that has a channel bottom that is always above the local water table.

Forb - a broad-leaved flowering plant, as distinguished from the grasses, sedges, etc.

Fugitive dust - particulate matter composed of soil that is uncontaminated by pollutants resulting from industrial activity.

Headwaters - small streams that are the sources of a river.

High-gradient streams - characterized by the majority of the stream having a moderate to fast current.

Host - an organism that is a source of food for a parasite. The parasite may live on the outside or inside of the host and may be harmful or harmless.

Hydrostatic testing - filling a pipeline with water under pressure to test for tensile strength (its ability to hold pressure without rupturing).

Intake - the place at which a liquid (primarily water) is taken into a pipe, channel, etc.

Intermittent stream - (a) A stream or reach of a stream that drains a watershed of at least one square mile, or (b) a stream or reach of stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground-water discharge.

Larval - an immature stage for an animal that is intermediate between the egg and the adult. The larva is different in appearance from the adult.

LC_{50}- concentration of a toxicant which is lethal to 50 percent of the organisms tested in a specified time.

Low-gradient stream - characterized by the majority of the stream having a moderate-to-slow current.

Mayfly - also known as shad flies, salmon flies, and June bugs. The adults are sluggish insects with slender filaments at the tail end of the body and have large triangular wings. The immature mayfly lives in the water, while the adult lives on land. The adult may live for only a few days, while the immature stage may last for several years.

Microgram - one millionth of a gram.

Mussel - an aquatic invertebrate two-shelled animal; a clam.

Particulate matter - pulverized material or droplets, typically averaging one micron or smaller in diameter.

Perennial stream - a stream or part of a stream that flows continuously during all of the calendar year as a result of ground-water discharge or surface runoff. The term does not include intermittent stream or ephemeral stream.

Periphyton - microscopic organisms that are attached to objects under water.

Phytoplankton - microscopic plant life suspended in the water of aquatic habitats.

Plankton - microscopic aquatic plants or animals.

Raptor - predatory bird, such as the eagle, hawk, and owl.

Reproductive potential - the potential number of offspring that could be produced.

Riparian - relating to or living on the bank of a river or stream.

Riprap - a foundation or sustaining wall of stones (as on an embankment slope) to prevent erosion.

Stipulation - a legal requirement.

TL_{50}- median tolerance limit; concentration of a test material at which just 50 percent of the test organisms are able to survive for a specified period of exposure.

Turbid - muddy or cloudy from having the sediment stirred up and suspended in the water column.

Unit train - a train whose entire cargo is loaded from one source and delivered to only one customer.

Vascular plants - plants that have specialized tissues that move water and food throughout the plant.

Watershed - the area drained by a river or river system.

Zooplankton - small microscopic animals suspended in the water of aquatic habitats.

Chapter 7

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